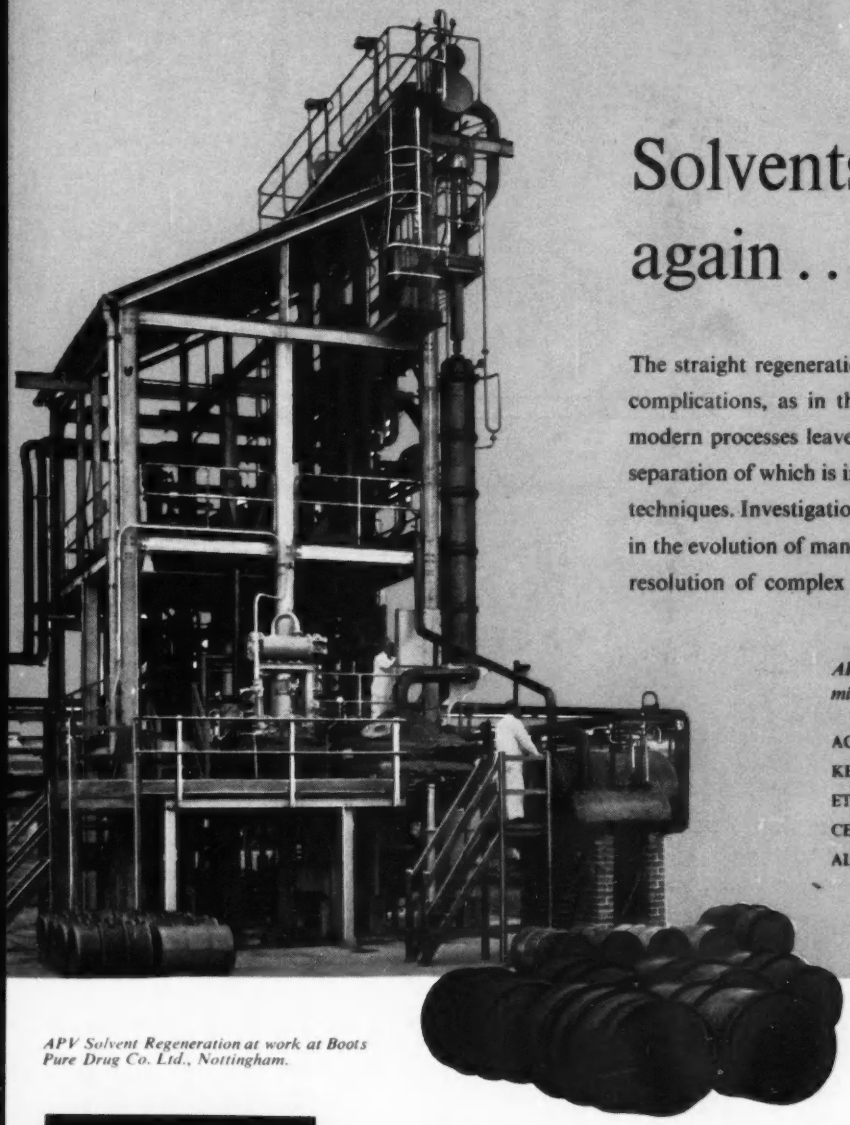
Chemical Age

O.E.E.C. REPORT ON EUROPE'S CHEMICAL INDUSTRY
(page 277)

VOL. 81 No. 2066

14 February 1959



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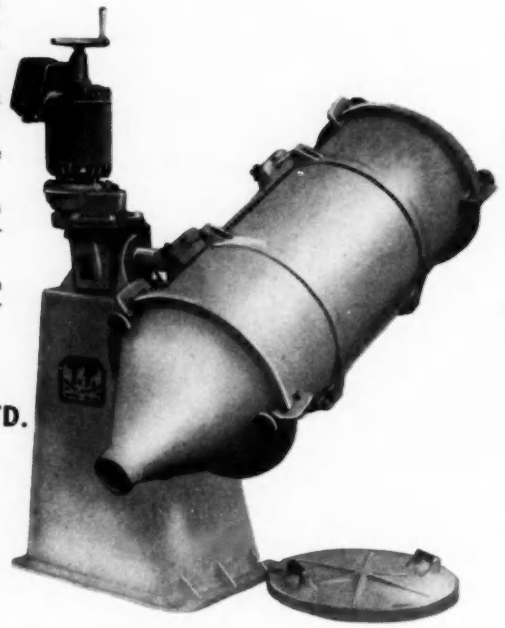

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INDEX TO ADVERTISERS

The first figures refer to advertisements in **Chemical Age Directory & Who's Who,** *the second to the current issue*

Page		Page
160	A.P.V. Co. Ltd., The	Front cover
154	Acalor (1948) Ltd.	—
85	Accrington Brick & Tile Co. Ltd., The	—
	African Pyrethrum Technical Information Centre Ltd.	300
117	Air Trainers Link Ltd.	—
131	Albany Engineering Co. Ltd., The	—
	Albright & Wilson (Mfg.) Ltd.	—
	Alchemy Ltd.	—
86	Alginate Industries Ltd.	—
100	Allen, Edgar, & Co. Ltd.	—
118	Allen, Frederick (Poplar) Ltd.	—
	Alumina Co. Ltd., The	—
	Amalgamated Oxides (1939) Ltd.	—
	American Cyanamid	—
102	Anglo-Dal Ltd.	—
	Anthony, Mark & Sons Ltd.	295
166	Armour Chemical Industries Ltd.	270
G/Card	Ashmore, Benson, Pease & Co.	—
	Ashworth, Arthur, Ltd.	—
	Associated Electrical Instruments Ltd. Turbine-Generator Division	—
103	Associated Lead Mfrs. Ltd.	—
G/Card	Audley Engineering Co. Ltd.	—
169	Automotive Products Ltd.	—
	Avo Ltd.	—
	Baird & Tatlock Ltd.	—
143	Baker Perkins Ltd.	—
159	Balfour, Henry, & Co. Ltd.	—
	Balfour Group of Companies, The	—
120	Barclay Kellett & Co. Ltd.	—
	Bennett, H. G., & Co. (Gloves) Ltd.	—
87	Bennett, Sons & Shears Ltd.	—
G/Card	Berk, F. W., & Co. Ltd.	—
104	Bivac Air Company Ltd.	—
132	Black, B., & Son Ltd.	—
2	Blackman, Keith, Ltd.	—
197	Blundell & Crompton Ltd.	—
	Borax & Chemicals Ltd.	—
84	Borax Consolidated Ltd.	—
4	Boulton, William, Ltd.	—
97	Bourne Chemical Industries Ltd.	—
	Bowmans Chemicals Ltd.	—
119 & 147	Braby, Frederick, & Co. Ltd.	—
86	Bristol Piping Co. Ltd., The	—
	British Acheson Electrodes Ltd.	—
	British Carbo Norit Union Ltd.	268
	British Ceca Co. Ltd., The	—
	British Drug Houses Ltd., The	—
	British Dyewood Co. Ltd., The	—
146	British Ermeto Corporation Ltd.	—
Spine	British Geon Limited	—
	British Industrial Solvents	—
220	British LaBour Pump Co. Ltd.	—
	British Lead Mills Ltd.	—
Spine	British Resin Products Ltd.	—
132	British Rototherm Co. Ltd., The	—
89	British Steam Specialties Ltd., The	—
134	British Tar Products Ltd.	—
	British Thomson-Houston Co. Ltd., The	—
231	British Titan Products Co. Ltd.	—
267	Broadbent, Thomas, & Sons Ltd.	—
137	Brotherhood, Peter, Ltd.	—
	Brough, E. A., & Co. Ltd.	—
101	Bryan Donkin Co. Ltd., The	—
	Burndept Ltd.	—
132	Burnett & Rolfe Ltd.	—
162	Bush, W. J., & Co. Ltd.	—
	Buss Ltd.	—
88	Butterfield, W. P., Ltd.	—
	Butterworths Scientific Publications	—
126	Calder Vale Glassworks Ltd.	—
	Callow Rock Lime Co. Ltd., The	—
	Cambridge University Press	—
	Cannon (CP) Ltd.	—
	Carbon Dioxide Co., The	—
	Catterson-Smith, R. M., Ltd.	—
210	Causeway Reinforcement Ltd.	—
	Chapman & Hall Ltd.	—
	Chemical Age Enquiries	301 & 302
178	Chemical Construction (G.B.) Ltd.	—
	Chemical & Insulating Co. Ltd., The	—
106	Chemical Workers' Union	—
	Chemicals & Feeds Ltd.	—
	Chemidus Plastics Ltd.	—
	Chemitrade Ltd.	—
	Christy & Norris Ltd.	—
	Ciba (A.R.L.) Ltd.	271
110	Ciba Clayton Ltd.	—
	Ciech Ltd.	—
	City Engineering Co. (Boreham Wood) Ltd.	—
	Clark Ltd.	—
	Classified Advertisements	298, 299 & 300
95	Clayton, Son & Co. Ltd.	—
142	Clydesdale Chemical Co. Ltd., The	300
	Cochran & Co. (Annan) Ltd.	—
	Cohen, George, Sons & Co. Ltd.	—
121	Cole, R. H., & Co. Ltd.	—
90	Collins Improved Firebars Ltd.	—
	Colt Ventilation Ltd.	267
	Colvin-Smith Ltd.	—
133	Comet Pump & Eng. Co. Ltd., The	—
	Constable & Co.	—
	Constructors, John Brown, Ltd.	—
	Contoura Photocopying Ltd.	—
	Controlled Convection Drying Co.	—
	Crofts (Engineers) Ltd.	—
	Cromil & Piercy Ltd.	—
	Crosfield, Joseph, & Sons Ltd.	—
99	Cruickshank, R., Ltd.	—
214	Curran, Edward, Engineering Ltd.	—
171	Cyanamid of Great Britain Ltd.	—
88	Cyclops Engineering Co. Ltd., The	—
	Cygnet Joinery Ltd.	—
	Dalglish, John, & Sons Ltd.	—
150	Danks of Netherton Ltd.	—
149	Davey & Moore Ltd.	—
173	Davey, Paxman & Co. Ltd.	—
	Dawson, McDonald & Dawson Ltd.	—
94	Derby Luminescents Ltd.	—
175	Distillers Co. Ltd., The (Chemical Div.)	—
	Distillers Co. Ltd., The (Engineering Div.)	—
163	Dorr-Oliver Co. Ltd.	—
139	Doulton Industrial Porcelains Ltd.	—
	Dowlow Lime & Stone Co. Ltd., The	—
136	Dring & Fage Ltd.	264
183	Drummond Patents Ltd.	—
151	Dryden, T., Ltd.	268
	Dupree Swift & Co. Ltd.	—
96	E.C.D. Ltd.	—
200	Electric Resistance Furnace Co. Ltd.	—
	Electro-Chemical Engineering Co. Ltd.	—
	Electronic Switchgear (London) Ltd.	—
	Electrothermal Engineering Ltd.	—
	Elga Products Ltd.	—
	Elliott, H. J., Ltd.	—
158	Elmatic	—
	Enamelled Metal Products Corporation (1933) Ltd.	—
	Engelhard Industries Ltd. (Hanovia Lamps Division)	—
111	Engelhard Industries Ltd. (Baker Platinum Division)	—
	English Glass Co. Ltd., The	—
G/Card	Erinoid Ltd.	—
	Evans, Joseph, & Sons (Wolverhampton) Ltd.	—
	Evered & Co. Ltd.	—
	Evershed & Vignoles Ltd.	—
	Extrudex Ltd.	—
90	Farnell Carbons Ltd.	—
	Fawcett, Preston & Co. Ltd.	—
124	Feltham, Walter H., & Son Ltd.	—
	Ferraris, Fred. Ltd. (Clerkenwell)	—
138	Ferris, J. & E., Ltd.	—
130	Film Cooling Towers (1925) Ltd.	—
	Fisher Governor Ltd.	—
	Foamite Ltd.	—
	Ford, T. B., Ltd.	274
	Foster Instrument Co. Ltd.	—
93	Foxboro-Yoxall Ltd.	—
	Freeman Taylor Machines Ltd.	—
198	Fuller's Earth Union Ltd., The	—
	Gallenkamp, A., & Co. Ltd.	—
	Gas Council, The	—
	General Electric Co. Ltd.	—
134	Glebe Mines Ltd.	—
218	Goodyear Pumps Ltd.	—
	Gowllands Ltd.	—
107	Graviner Mfg. Co. Ltd.	—
109	Grazebrook, M. & W., Ltd.	—
122	Greeff, R. W., & Co. Ltd.	—
	Grindley & Co. Ltd.	—
138	Haller & Phillips Ltd.	—
124	Harris (Lostock Gralam) Ltd.	296
	Hartley Electromotives Ltd.	—
	Haworth, F. (A.R.C.), Ltd.	—
144	Heathway Machinery Co. Ltd.	—
	Herbert, Alfred, Ltd.	—
	High Pressure Components Ltd.	—
	Hilger & Watts Ltd.	—
183	Holland, B. A., Eng. Co. Ltd., The	—
	Hopkin & Williams Ltd.	—
	Humphreys & Glasgow Ltd.	—
6	Huntington, Heberlein & Co. Ltd.	—
	I.C.I. Billingham	265
	I.C.I. Catalysts	—
	I.C.I. General Chemicals Solvents	—
	I.C.I. Metals Titanium D.	273
	I.C.I. Plastics—Darvic	—
	I.C.I. Plastics—Fluon	—
	I.C.I. Ltd. (Plastics Division), Corvic	—
	I.C.I. (Florube) Ltd.	—
	Industrial Descaling Tools Ltd.	—
	Industrial Tapes Ltd.	—
	Infra Red Development Co. Ltd., The	—
	International Combustion Group	—

(continued on page 266)

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B269

INDEX TO ADVERTISERS

The first figures refer to advertisements in **Chemical Age Directory & Who's Who,** *the second to the current issue*

Page		Page
127	International Furnace Equipment Co. Ltd., The	—
	Interscience Publishers Ltd.	289
	Isopad Ltd.	—
102	Jackson, J. G. & Crockatt Ltd.	—
125	Jenkins, Robert, & Co. Ltd.	
	Jenkinson, W. G., Ltd.	—
3	Jobling, James A., & Co. Ltd.	—
	Johnson, Matthey & Co. Ltd.	—
98	Johnsons of Hendon Ltd.	—
108	K.D.G. Instruments Ltd.	—
148	K.W. Chemicals Ltd.	—
	Kay Brothers Plastics	—
	Kaylene (Chemicals) Ltd.	—
	Kellogg International Corporation	—
110	Kernick & Son Ltd.	—
265	Kestner Evaporator & Engineering Co. Ltd.	—
	Kestner Evaporator & Engineering Co. Ltd. (*Keebush*)	—
	Kestner (Industrial Safety) Ltd.	—
130	Kier, J. L., & Co. Ltd.	—
	King, G. W., Ltd.	—
208	Kingsley & Keith Ltd.	—
184	Kleen-e-ze Brush Co. Ltd., The	—
122	Laboratory Apparatus & Glass Blowing Co.	—
224	Lambeth & Co. (Liverpool) Ltd.	—
	Langley Alloys Ltd.	—
112	Lankro Chemicals Ltd.	—
205	Laporte Chemicals Ltd.	—
114	Lavino (London) Ltd.	—
173	Leda Chemicals Ltd.	—
96	Leek Chemicals Ltd.	—
	Lees, Henry, & Co. Ltd.	—
112	Leigh & Sons Metal Works Ltd.	—
	Lennig, Charles, & Co. (Great Britain) Ltd.	—
	Lennox Foundry Co. Ltd.	—
129	Light, L., & Co. Ltd.	—
135	Lind, Peter, & Co. Ltd.	—
118	Liquid Solid Separations Ltd.	—
B/cover	London Aluminium Co. Ltd., The	—
142	London Sand Blast Decorative Glass Works Ltd., The	—
	Longman Green & Co. Ltd.	—
	Longworth Scientific Instruments Co.	—
92	Lord, John L., & Son	—
	Loughborough Glass Co. Ltd.	—
	McCarthy, T. W., & Sons Ltd.	—
	MacLellan, George, & Co. Ltd.	—
	Maine, B. Newton Ltd.	—
126	Manesty Machines Ltd.	—
177	Marchon Products Ltd.	—
108	Matthews & Yates Ltd.	—
	May & Baker Ltd.	—
	Measuring & Scientific Equipment Ltd.	—
	Medway Paper Sacks Ltd.	—
	Mervyn Instruments & Co. Ltd.	—
Front cover	Metal Containers Ltd	—
	Metafiltration Co. Ltd.	—
G/card	Metalock (Britain) Ltd.	—
126	Metcalf & Co.	—
	Metropolitan-Vickers Electrical Co. Ltd.	—
148	Middleton & Co. Ltd.	—
	Mills Packard Construction Co. Ltd.	—
	Mine Safety Appliances Co. Ltd.	—
	Mirrlees Watson Co. Ltd., The	—
140	Mirvale Chemical Co. Ltd., The	—
141	Mitchell Cotts Co. Ltd.	—
	Mond Nickel Co. Ltd., The	—
120	Monkton Motors Ltd.	272
	Monsanto Chemicals Ltd.	—
	Moritz Chemical Engineering Co. Ltd.	—
	Mulberry Co., The	—
82	Neckar Water Softener Co. Ltd.	—
115	Negretti & Zambra Ltd.	—
	New Metals & Chemicals Ltd.	—
	Newnes, George, Ltd.	287
	Nicolson, W. B. (Scientific Instruments) Ltd.	—
	Nitrate Corporation of Chile Ltd.	—
	Nordac Ltd.	—
146	Odoni, Alfred A. & Co. Ltd.	—
G/card	Oil & Colour Chemists' Association	273
	Operation Britain	Cover iii
136	Optical-Mechanical (Instruments) Ltd.	—
	Orr Products Ltd.	—
	Palfrey, William, Ltd.	—
	Pascall Engineering Co. Ltd., The	—
8	Paterson Engineering Co. Ltd., The	—
161	Peabody Ltd.	—
	Penrhyn Quarries Ltd.	—
	Permali Ltd.	—
194 & 235	Permutit Co. Ltd., The	—
G/card	Petrocarbon Developments Ltd., The	—
	Petrochemicals Ltd.	—
150	Plastic Filters Ltd.	—
	Platon, G. A., Ltd.	—
154	Podmores (Engineers) Ltd.	—
206	Polypenco Ltd.	—
223	Pool, J. & F., Ltd.	—
	Pott, Cassels & Williamson Ltd.	—
	Potter, F. W., & Soar Ltd.	—
180	Powell Duffryn Carbon Products Ltd.	—
G/card	Power-Gas Corporation Ltd., The	—
197	Prat-Daniel (Stanmore) Ltd.	—
128	Price Stutfield & Co. Ltd.	—
	Price's (Bromborough) Ltd.	—
	Prodorite Ltd.	—
	Purkis, Williams Ltd.	—
190	Pye, W. G., & Co. Ltd.	—
162	Pyrometric Equipment Co. Ltd., The	—
	Q.V.F. Ltd.	—
	Quickfit & Quartz Ltd.	—
186	Reads Ltd.	—
140	Rediweld Ltd.	—
	Research Utilities Ltd.	—
	Reynolds & Branson Ltd.	—
	Rheem Lysaght Ltd.	Cover iv
	Richmond Welding Co. Ltd.	—
	Robinson, F., & Co. Ltd.	—
G/card	Rose, Downs & Thompson Ltd.	—
153 & 188	Dr. Rosin Industrial Research Co. Ltd.	—
124	Rotometer Manufacturing Co. Ltd.	
	S.I.C. Plastics Ltd.	—
118	S.P.E. Company Ltd.	—
113	Sandiacre Screw Co. Ltd., The	—
	Scientific Glass-Blowing Co. Ltd.	—
	Scientific Instrument Manufacturers' Association of Great Britain Ltd.	—
	Scott, Ernest, & Co. Ltd.	—
	Scott, George, & Son (London) Ltd.	—
	Sharples Process Engineers Ltd.	—
	Shaw Petrie Ltd.	—
193	Shell Chemical Co. Ltd.	269
	Shell-Mex & B.P. Ltd.	—
	Short & Mason Ltd.	—
91	Siebe, Gorman & Co. Ltd.	—
	Siemens Edison Swan Ltd.	—
	Sifam Electrical Instrument Co. Ltd.	—
	Simon, Richard, & Sons Ltd.	—
	Sipon Products Ltd.	—
128	Southern Instruments Computer Division	—
145	Spencer Chapman & Messel Ltd.	—
	Stabilag Co. Ltd., The	272
266	Stanton Instruments Ltd.	—
	Stationery Office, Her Majesty's	—
	Staveley Iron & Chemical Co. Ltd.	—
92	Steel, J. M., & Co. Ltd.	—
	Steel & Cowlishaw Ltd.	—
	Stockdale Engineering Co. Ltd.	—
	Stonehouse Paper & Bag Mills	300
	Streamline Filters Ltd.	—
	Sturge, John & E., Ltd.	—
	Sutcliffe Speakman & Co. Ltd.	—
156	Synthite Ltd.	—
149	"T.P." Chemical Engineering Co. Ltd.	Cover ii
155	Taylor Rustless Fittings Co. Ltd., The	—
142	Taylor Stainless Metals Ltd.	—
152	Thermal Syndicate Ltd., The	—
	Thermo Plastics Ltd.	—
	Thompson, John (Dudley) Ltd.	—
120	Titanium Metal & Alloys Ltd.	—
	Todd Bros. (St. Helens & Widnes) Ltd.	—
144	Towers, J. W., & Co. Ltd.	—
	Triangle Valve Co. Ltd.	—
210 & 224	Tylors of London Ltd.	—
	Unicone Co. Ltd., The	293
	Unifloc Ltd.	297
	Unilever Ltd.	—
	Union Carbide Ltd.	263
	United Coke & Chemicals Co. Ltd.	—
104	United Filters & Engineering Ltd.	—
G/Card	Universal-Matthey Products Ltd.	—
	Vacu-Blast Ltd.	—
	Vaughan Crane Co. Ltd.	—
	Voss Instruments Ltd.	—
183	W.E.X. Traders Ltd.	—
	Walker, James, & Co. Ltd.	—
	Walker, P. M., & Co. (Halifax) Ltd.	—
	Wallach Bros. Ltd.	272
105	Waller, George, & Son Ltd.	—
98	Wallis, Charles, & Sons (Sacks) Ltd.	—
123	Ward, Thos. W., Ltd.	—
	Warren-Morrison Ltd.	—
152	Watson, Laidlaw & Co. Ltd.	—
	Wellington Tube Works Ltd.	—
116	Wells, A. C., & Co. Ltd.	—
220	Wengers Ltd.	—
	Whessoe Ltd.	—
	Whiffen & Sons Ltd.	—
184	Whitaker, B., & Sons Ltd.	Cover ii
123	Widnes Foundry & Engineering Co. Ltd.	—
202	Wilcox, W. H., & Co. Ltd.	—
136	Wilkinson, James, & Son Ltd.	—
94	Williams & James (Engineers) Ltd.	—
122	Wilson, Edward, & Son Ltd.	—
114	Wood, Harold, & Sons Ltd.	—
156	Worcester Royal Porcelain Co. Ltd., The	—
	Worthington-Simpson Ltd.	—
	Wynn (Valves) Ltd.	—
116	Yorkshire Tar Distillers Ltd.	—
106	Zeal, G. H., Ltd.	—

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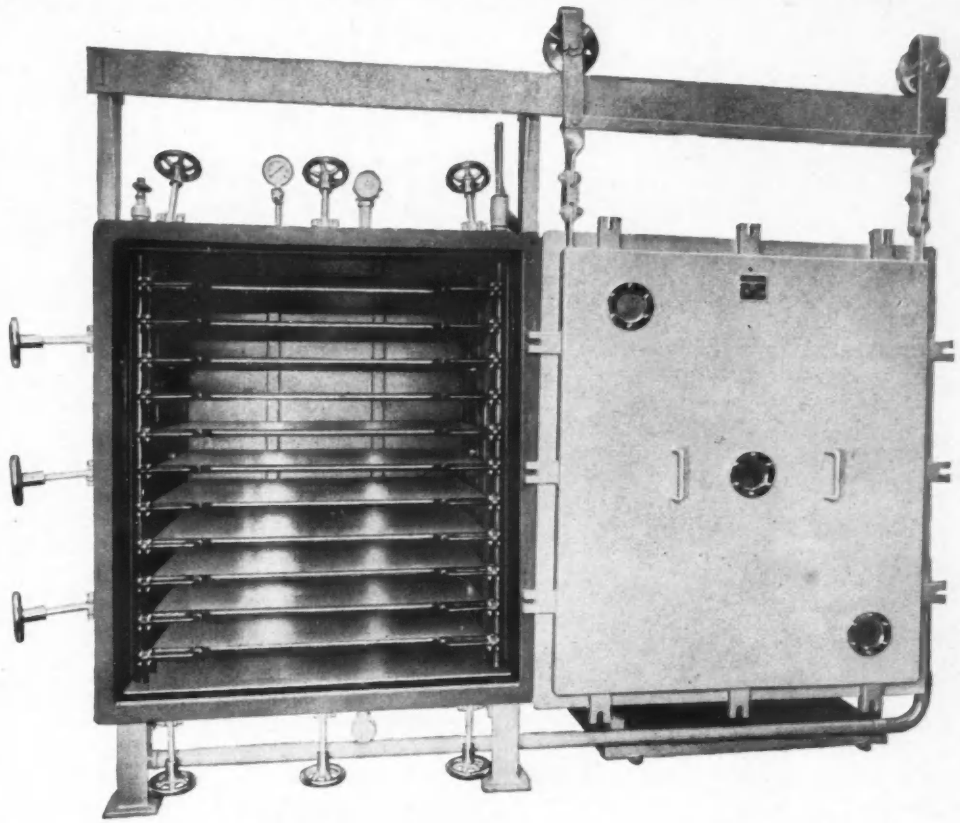

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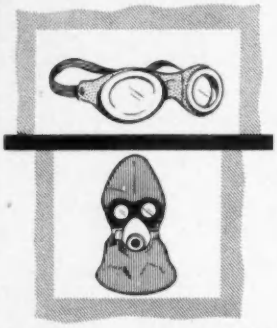

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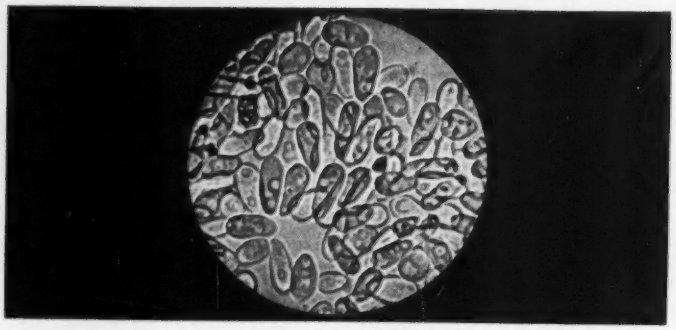

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IN THIS ISSUE

Chemical Industry in Europe	277
Distillates	280
Developments in Corrosion Probes	281
Device for Calibrating Dials	282
Humglas Acquire PEC Fertiliser Processes	283
Woodall-Duckham—Automatic Reforming Plant	283
Analytical Chemistry of Co and Ni	284
Process for Alkyl-boric Acid Esters	285
Bookshelf	286
Plants and Mathematical Analytical Content	290
Plastics Exports Record Tonnage	290
Overseas News	291
People	293
Commercial News	294
Markets	294
Trade Notes	295
Diary	295
Patents	296

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CHEMICAL AGE

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EUROPE CHEMICALS

DEMAND for European chemicals on world markets (expressed by O.E.E.C. member countries' exports to overseas territories, dollar area and 'other countries') rose in 1957 by 13% compared with 7% in 1956. In particular the demand from "other countries was notable." The proportion of O.E.E.C. countries' chemical production devoted to meet the demand of non-member countries therefore rose slightly last year, although it is still only 12% of O.E.E.C. countries' total production of chemicals. This is stated in the study prepared by the Chemical Products Committee Organisation for European Economic Co-operation (5th year). In the main the O.E.E.C. report reveals that during 1957 there was some levelling out of economic activity in Europe after the vigorous expansion which had lasted since 1953. European industrial production showed only a small increase and the second quarter of 1958 showed a decline. This slackening in output in 1958 is due mainly to a slight fall in export demand, a levelling out in investment and a cessation or even reversal of stock piling.

Sales of basic chemicals are reported to account for about a third of the gross output of the chemical industry, with the other branches accounting for two-thirds of this. About 30% represents demand for pharmaceuticals, soaps and other products for direct consumption, about 15% of total demand comes from abroad and demand for the remainder comes from agriculture and home industries such as the textile and building industries.

An appreciable demand for organic chemicals is noted for 1957. In particular demand for petrochemicals which rose 34% in 1957 is expected to triple between 1957 and 1960. Demand for inorganics also appears to be increasing, although this is at a lower rate than demand for chemicals as a whole.

Plastics materials demand has shown no sign of slackening. Consumption is estimated to have increased by 21%. An appreciable demand for dyestuffs in 1957 is recorded, but the improvement in value (+ 14%) was greater than the improvement in tonnage (+ 11%). A fall in demand is expected to be shown for 1958. This industry is very closely allied to the textile industry, which has not only a slow rate of expansion but is also subject to considerable fluctuations in activity. It is suggested, however, that the other consumer industries which account for about one-third of the demand for dyestuffs and are expanding more rapidly, may in future account for a large proportion of dyestuffs consumption.

The rate of increase in estimated consumption of synthetic detergents fell off considerably in 1957, consumption only rising by 5% over 1956, compared with the 13% increase in 1956 over 1955. It is expected that further progress will be made, but at a slower pace, except in those countries where consumption of these products is still low.

Demand for nitrogenous and potash fertilisers on home markets increased by 7% in 1957-58. For potash fertilisers this was a slightly higher rate than previously. Demand for phosphate fertilisers rose, however, by only 4%, as against 5% in 1956-57. The 1958-1959 forecasts show an

increase of 7% in demand for nitrogenous fertilisers and 5% in demand for phosphate and potash fertilisers.

The O.E.E.C. report indicates that the rate of expansion of chemical production in 1957 was again still higher than that of manufacturing industries and total industrial production (expressed as a percentage respectively 10, 6 and 5%). As is to be expected the rate of expansion in chemical production varied from country to country. As can be noted in p. 277, output in France rose by 16%, in Western Germany by 12% and in Austria by 11%. Increases in the other countries were lower. A comparison with U.S. chemical industry shows that that country's industry increased less than output in O.E.E.C. countries. Production rose 4%, compared with 6% in 1956, and 13% in 1955. O.E.E.C. countries' chemical production increased by 6% in the first six months of 1958 compared with the same period in 1957, whereas in the U.S. chemical output fell by 3%, due to the recession.

PRODUCTION CAPACITY

Conclusions drawn regarding the use of production capacity are that production capacity was fully used in the petroleum chemicals and plastics materials industries and that capacity is increasing to meet demands. As was noted in CHEMICAL AGE (10 January issue) production capacity of chlorine was used to a satisfactory extent in this country and in most O.E.E.C. countries. The progress noted in chlorine production is, of course, due to the growing demand from user industries and especially the chemical industry itself for the production of chlorinated solvents, p.v.c., etc., and for bleaching. Production capacity in the fertiliser industry varies with agricultural conditions. Rather less than 90% of capacity for the production of nitrogenous fertilisers, basic slag and potash fertilisers was used in 1957. Only three-quarters of capacity was used for single superphosphates as this particular section of the industry has had strong competition from complex and concentrated fertilisers recently.

Although chemical production in 1957 showed a 10% increase, there was no equivalent increase in the labour force employed (estimated in 1956 at 1.4 million persons, 400,000 of whom were administrative, technical and clerical staff). Increased production was due to the modernisation and mechanisation of machines and the use of automatic control. Most countries are still having difficulty in obtaining sufficient qualified technicians and skilled labour for the chemical industry. Of concern are the difficulties arising from emigration of qualified personnel due to tempting offers and the tendency of young persons trained abroad to accept posts in the countries of training.

Production trends in the various sectors of the chemical industry are dealt with in detail in the O.E.E.C. report. In general production of inorganic chemicals increased slowly in 1957. Sulphuric acid production which like chlorine, is considered a general indication of activity in the chemical industry, rose by only 3% compared with 5.5% in 1956. Chlorine output which closely follows the development of production of chlorinated solvents and plastics materials, increased by about 8% compared with 6% in 1956.

A fairly considerable increase in activity in the organic chemical industry in Belgium, France, Italy, Norway and Sweden is evident. Benzene consumption in these countries, for instance, was 20% higher in 1957 than in 1956, acetylene consumption 15% higher and naphthalene consumption 8% higher. Expansion has been greatest, however, in the petrochemicals section, an increase of 34% being noted for 1957 compared with the 19% increase for the previous year. A similar increase is expected in 1958.

Information on the trend of output of medicinal and pharmaceutical products is described as "scanty". Estimates suggest that output rose by at least as much as output in the chemical industry as a whole in 1957 (i.e. 10%). Total exports in pharmaceuticals rose by 16% and imports by 21%.

Output of soaps, the O.E.E.C. report shows, fell by 5% after an increase of 4% in 1956. A 7% increase occurred in the output in detergents as compared with 14% in 1956.

Plastics materials output rose more rapidly in 1957 (+19%) than in 1956 (+14%). This and the petrochemical sector has shown a rapid expansion. O.E.E.C. member countries' total sales, on home and export markets, at over 1.4 million tons, are rapidly approaching U.S. sales of rather less than 1.7 million tons. Sales of thermoplastics products rose by 24% in 1957 compared with 1956, and sales of thermosetting plastics by 17%. Of interest is the 5 to 10% (according to country) rise in production of photographic and cinematographic supplies. Trade in these supplies also showed a marked increase.

About $1,000 million was invested in the chemical industry in 1957 in eight countries, compared with about $940 million in 1956. As in recent years, investment has been heaviest in basic chemicals, including petrochemicals and plastics materials. Between 1958 and 1960, it is estimated, a further $650 million will be invested in the petrochemical plant which will increase the industry's output from 630,000 tons (in terms of carbon content) in 1957 to over 2 million tons three years later.

France and Sweden have announced investments in plant for chlorine production and in the Netherlands for plant to manufacture sulphuric acid. France, Italy and the Netherlands have made heavy investment in the nitrogenous fertiliser industry. Western Germany has announced investments in the pharmaceutical industry. In comparison, U.S. expenditure on new plant and equipment for the "chemical and allied" industries in 1957 was $1,724 million and $1,455 million in 1956. This rate of investment is expected to level off in the future.

PRICES STABLE

Generally chemical product prices were stable in 1957. In no country did prices rise by more than 3%. For O.E.E.C. countries as a whole the increase is estimated at between 1% and 3%. The sectors where price rises have occurred include dyestuffs, plastics materials, and soaps and paints. The increase in productivity due in turn to a higher rate of expansion in production of chemical products has kept prices down compared with wholesale prices in general. The U.S. price index for chemical and allied products rose from 108.7 in January 1957 to 110.6 in January 1958, an increase of less than 2%. (The price index for all commodities rose by 1.5%.) Higher increases were shown for paints, fertilisers and soaps and detergents. This increase in the wholesale prices of chemicals in the U.S. is contrary to that found in the O.E.E.C. countries.

The general rise in energy costs in 1957 is noted. Suez affected petroleum prices at the beginning of that year. The decrease in freight rates of such new materials as sulphur, pyrites, phosphate rock and vegetable oils as well as intermediates reduced c.i.f. prices.

The O.E.E.C. Chemical Products Committee completed their report in October 1958, using information available up to July 1958 in most instances. With the benefit of being able to examine 1958 as a whole, it is of interest to note how applicable are the Committee's remarks concerning nitrogen production capacity which are that "it remains to be seen whether in the nitrogen sector the appreciable expansion will keep pace with the growing surplus of production over international demand". Their remarks on plastics materials would seem to be somewhat cautious and they suggest that it is difficult to forecast the expansion rate in this industry.

TRENDS IN EUROPE'S CHEMICAL INDUSTRY

O.E.E.C. Report Notes Rising Demand for Organic Chemicals

EXPANSION of trade in chemicals continued in 1957, the 5th report of the Organisation for European Economic Co-operation prepared in 1958 shows. While the rate of increase in imports was the same as in 1956, exports rose more than in the previous year (12% as against 10%). Trade with non-member countries increased much more rapidly than trade between O.E.E.C. countries, thus reversing the trend in 1956. The increase in exports to non-member countries was greater than the increase in production in 1957.

In last year's O.E.E.C. report mention was made of the slowing down in the rate of expansion in intra-European trade during the first half of 1957. This continued during the second half of the year. Also intra-European trade rose less than trade with non-member countries. For imports this is a reversal of the position in 1956 but is in line with the general development since 1953 with imports from non-member countries expanding slightly more rapidly than intra-European trade.

Despite the rate of increase in intra-European trade being lower in 1957 than in 1956, there has been a marked development in trade in pharmaceutical products. Imports rose by 17% to reach $155 million, and exports by 22% to $111 million (all O.E.E.C. countries except Switzerland). Trade with overseas territories and non-member countries increased by 13% in 1957 or nearly double the rate of expansion in 1956 (7%).

Organic Imports

Dollar area imports. Growth in imports from the dollar area, rose by 15% in 1957 compared with an increase of 10% in imports from all other sources of supply. Most marked were the imports of organic chemicals, up to 32%, and accounting for nearly a quarter of total imports from the dollar area in 1957. Two organics imported in greatly increased quantities were phthalic anhydride and ethylene glycol. U.S. exports of the former to O.E.E.C. countries rose from $586,000 in 1956 to $2.6 million in 1957 and, of the latter, from $5.5 million in 1956 to $12.9 million. Other U.S. exports to O.E.E.C. countries which showed a rise were pharmaceutical and medicinal products (a rise of nearly 20%) the increase in exports of sulphonamides and antibiotics being particularly marked from $13.2 million to $17.8 million in 1957). Exports of plastics materials to O.E.E.C. countries rose even more. These were 23% higher than in 1956 and 66% higher than in 1955. Exports of synthetic resins also rose from $15.6 million in 1955 to $31.6 million in 1956 and $42.9 million in 1957.

O.E.E.C. exports. A rise of 10% is noted for O.E.E.C. countries' exports to the dollar area, but in certain groups (those which show large increases in imports from the dollar area such as organic chemicals and pharmaceutical products), the rise in exports was higher than the average. Exports of photographic and cinematographic supplies to the dollar area rose from $9 million in 1955 and $13 million in 1956 to $18.5 million in 1957. Expansion of exports to other countries is noted as the "outstanding feature of trade with non-member countries". Many sectors were affected, above all organic chemicals; paints and varnishes; medicinal aid pharmaceutical products; soaps and detergents; fertilisers and photographic supplies.

Demand for Chemicals

A rise of 13% compared with 7% in 1956 is noted in the demand for European chemicals on world markets.

Demand for organic chemicals rose appreciably in 1957, accounting for 18% of O.E.E.C. countries' total imports of chemical products and 14% of their total exports compared with 17% and 14% respectively in 1956.

Demand for nitrogenous and potash fertilisers on home markets increased by 7% in 1957-58. Demand for phosphate fertilisers rose only by 4%, compared with 5% in 1956-57.

United Kingdom. Turnover of the U.K. chemical industry in 1957 is provisionally estimated at £1,310 million compared with £1,235 million in the previous year, and £1,153 million in 1955. The trend in production is reported to be the same as in 1956. Output of plastics material and petroleum chemicals measured by carbon content increased considerably (+14% and +25% respectively); general chemicals and paints continued to be produced at a moderately increased rate. Total fertiliser production was unchanged as compared with 1956 in contrast to the sharp rise which occurred in the previous year. Soap production rose slightly but the high level of output noted in the first nine months of the year was not maintained in later months. Output of detergents did not differ significantly from that of 1956. Dyestuffs production which had declined somewhat in 1956, recovered its lost ground in 1957.

The production index for the chemical industry during the first half of 1958 was 128 as against 133 for the same period in 1957. Plastics materials production showed a reduced rate of increase (+3%). Synthetic detergents (+6%) showed a good increase while soap production fell by 10%. Persons employed in the chemical industry totalled 358,000 in 1956, 241,000 of whom were operatives, and 117,000 administrative, technical and clerical staff. Provisional estimates had shown no significant change in the level of employment between 1956 and 1957.

Investment in the chemical and allied trades (other than oil refining) is provisionally assessed at £134 million ($375 million) in 1957, an increase of 10% on 1956 when investment amounted to £122 million. (£89 million were invested in 1955 and £80 million in 1954.) Sectors where expansion is most rapid continue to be those of plastics materials and petrochemicals. Investment in the first half of 1958, however, is provisionally estimated to have been slightly lower than a year earlier as compared with an increase of 20% for manufacturing industry as a whole. Taking into account the provisional figures for the first half of 1958 and forecasts for the year as a whole, it is estimated that investment in the chemical and allied trades should be about the same as 1957 although possibly a little lower.

Higher wholesale prices, in general, in 1957 than in 1956 are noted. Prices of basic chemical materials as a whole declined in course of the year being 10.8% lower in December compared with a year earlier. Of the main groups of production, the only one to decline over the year was synthetic resins and plastics materials which fell by just under 2%.

Price Index Falls

The wholesale price index for chemical and allied products fell slightly more than for all manufactured goods and was 1.5% below the December 1957 level. Pharmaceuticals and general chemicals followed the downward trend but toilet preparations and perfumery (+3.4%) and soap (+2.7%) showed increases.

U.K. chemical exports of $779 million were 9% above the 1956 level. Plastics materials, drugs, medicines and medicinal preparations, and tetra-ethyl lead anti-knock compounds all increased by more than average, and exports of manufactured fertilisers were nearly four times as much by value as in 1956 (but still lower than in 1955). Exports of mineral tar and crude chemicals from coal, petroleum and natural gas were down on 1956. Shipments to Australia, New Zealand, South Africa, Canada and most Western European countries and the Scandinavian markets were higher, but India, the U.S. and Egypt took less.

Chemical imports to the U.K. totalled $325 million, a 7% increase on 1956. Most of the increase was due to higher

imports from the U.S. ($6.2 million higher). Western Germany ($3.9 million higher), Canada ($2.5 million higher), Japan ($2 million higher), other Western European countries and Poland. Imports from the Netherlands Antilles decreased. Imports of calcium carbide, organic acids, salts, esters and alcohols, antibiotics and plastics materials rose while imports of alkali and alkaline earth metals, selenium, styrene and vinyl acetate (monomer) fell.

Western Germany. Turnover of West Germany's chemical industry in 1957 amounted to DM 16,445 million compared with DM 14,800 million in 1956 and DM 13,005 million in 1955.

During the first half of 1958 the production index for the chemical industry was 167, an increase of 7.7% on the first half of 1957. The industrial production index was 147, an increase of 2%. It is considered likely that production during the year 1958 is likely to be higher than in 1957, but the rate of expansion will probably be lower than in previous years.

W. GERMAN PRODUCTION INDICES

	Basic Inorganic Chemicals	Basic Organic Chemicals	Intermediate Products	Chemicals for Direct Consumption
1956 ...	134	129	150	126
1957 ...	145	142	169	142
Increase in 1957 on 1956 ...	8%	10%	13%	13%
1st half, 1958	148	147	179	158

The labour force employed in West Germany's chemical industry increased by 4.6% in 1957 compared with 4% in 1956, and there was a further increase of 5% in the first half of 1958.

Chemical industry investment amounted to DM 1,320 million ($315 million) in 1957, compared with DM 1,280 in 1956. Investment was concentrated in petrochemicals, in plastics materials, in organic solvents, and in pharmaceuticals.

Prices of chemicals did not vary appreciably in 1957 compared with 1956. Prices of inorganic chemicals rose by 3%; chemicals for direct consumption—pharmaceuticals, soaps and detergents, perfumes and cosmetics, etc.—by 2%. Chemical prices indices are in general lower than those for other industries (116 for coal industry (1953 = 100), oil production and processing 107, etc.).

Rise in Exports

West German chemical exports rose from $797 million in 1956 to $926 million in 1957, an increase of 16% (14% in the previous year). Exports of plastics materials and pharmaceuticals to all European markets rose and there were also developments in exports to Africa and South America where sales of plastics materials increased considerably.

Chemical imports rose from $194 million in 1956 to $235 million in 1957. The rate of increase (21%) was considerably greater than that of imports in general (13%) and chemicals now account for 3.6% of total imports compared with 3.3% in 1956. The two principal suppliers were the U.K. and U.S. German imports from the U.K. increased by $3.8 million for chemicals in general, and by $835,000 for pharmaceuticals. From the U.S., Western Germany imported chemicals in general, plastics materials and pharmaceuticals. Plastics materials imports included special preparations for which Western Germany's own production capacity is not yet sufficient. In the pharmaceutical sector, the major item imported was anti-poliomyelitis vaccine ($1.36 million in 1957 compared with $48,000 in 1956 from the U.S.).

During the first six months of 1958, imports of chemicals at $132 million, were 20% higher than in the similar period of 1951, while the increase in exports was much smaller (+4%). These amounted to $486 million, of which intra-European trade accounted for $257 million.

France. Turnover of the French chemical industry amounted to Fr. Frs. 1,123,000 million in 1957, compared with Fr. Frs. 990,000 million in 1956.

PRODUCTION INCREASES

O.E.E.C. countries production of various chemicals in 1957 increased as follows:

- **Soda ash: increases noted for Norway, France and Austria; decreases for U.K., Belgium, Portugal, W. Germany.**
- **Caustic Soda: increases noted for U.K., Italy, W. Germany, Norway and Denmark; decreases for France and Belgium.**
- **Chlorine: All O.E.E.C. countries showed increased production with the exception of Belgium.**
- **Calcium carbide: increased production in U.K., Belgium, France, W. Germany, Netherlands and Norway; Austria, Italy, and Portugal, decreased production.**
- **Petrochemicals: in terms of carbon content up 34%.**
- **Nitrogenous fertilisers: up by 13.7%.**
- **Phosphate fertilisers: up 4%.**
- **Potash fertilisers: up 4%.**
- **Concentrated superphosphates: up 15%.**
- **Complex fertilisers: up 15%.**

Production indices show an increase of 15.7% in 1957 over 1956, compared with 10.1% in the previous year. Some sectors of France's chemical industry progressed more than others. Taking 1953 as the base year, the 1957 index for the inorganic chemical industry is 143, for the organic chemical industry (which includes petrochemicals and plastics materials) 252, and for the allied products (paints, abrasives, perfumes, etc.) 145.

Of the inorganic chemicals, chlorine shows the greatest increase in tonnage in 1957 over 1956 (+15.4%), followed by calcium carbide (+10%). Production of some basic organic chemicals also developed considerably, in particular methanol (+24%), acetone (+17%), butyl alcohol, etc.

The favourable trend in production in 1957 was maintained during the first half of 1958. Production rose by 18% over the first six months of 1957, compared with the 10% increase in industrial production in general.

The number of persons employed in the French chemical industry numbered 234,000 and consisted of 21,000 technical and managerial staff; 48,000 salaried employees; and 165,000 operatives.

Investment in French chemical industry totalled Fr. Frs. 58,000 million ($154.5 million) in 1957. The industries concerned were organic chemicals, petrochemicals, plastics materials, synthetic fibres, nitrogenous fertilisers and chlorine.

Three polythene plants and a butyl rubber plant are in course of construction and progress is being made with plans to construct an S-type synthetic rubber plant.

Investments were maintained in the first half of 1958 at the same rate as in 1956. In the petrochemical sector a catalytic plant to manufacture aromatic hydrocarbons was brought on stream early in 1958. This plant will markedly increase the supply of pure benzene, it is stated.

New French Chemicals

New chemicals on the French market in 1957 were plastics materials based on melamine and allyl derivatives, epoxy resins, anti-crease products for the textile industry, antibiotics and systemic insecticide.

Foreign trade in chemicals increased considerably in 1957, the O.E.E.C. report indicates; exports were 21% higher than in 1956 and imports 13% higher. The sectors where the exports rose were plastics materials, pharmaceutical products (vitamins, hormones, antibiotics, sera and vaccines), acetone, coal tars and benzoles, essential oils and perfumery, sensitised surfaces. In the inorganic chemical sector exports of caustic soda fell but there were increased exports of chlorates, sodium carbonate, potash and nitrogenous fertilisers. Exports to French overseas territories rose appreciably, in particular, exports of nitrogenous and complex fertilisers, plastics materials, pharmaceutical products, dyestuffs, sensitised surfaces, detergents, etc., insecticides, and paints and varnishes.

The overall increase in imports by France was due to higher imports of plastics materials (in particular polythene), synthetic rubber, antibiotics and sera and vaccines. There was a marked decline in imports of styrene (monomer), butyl alcohols, and industrial fatty alcohols. In the inorganic chemicals sector, imports of selenium, nitrogenous fertiliser, and copper sulphate have declined. Imports of petrol refining catalysts, artificial iron oxides, polyphosphates and titanium oxide have increased.

Exports to other O.E.E.C. countries which accounted for 36% of French exports of chemicals in 1957, increased by 10% on 1956, and trade with 'other countries' by 12%.

In the first half of 1958 exports of chemicals remained stable. Imports fell by 13% compared with the first half of 1957.

Italy. Chemical industry turnover was Lire 1,280,000 million in 1957 compared with Li.e 1,120,000 million in 1956. A lower rate of increase in production in 1957 was due to the agricultural situation, since consumption of fertilisers, particularly of phosphate fertilisers did not increase as expected. Production of inorganic chemicals rose more slowly than previously but progress was made in the organics sector. The production index for the chemical industry was 153 for the first four months of 1958, compared with 149 in the same period of 1957.

Italian chemical industry employed 195,000 persons in 1957 (same as 1956), 150,000 of whom were operatives and 45,000 managerial, technical and clerical staff.

Investment in the Italian chemical industry totalled Lire 130,000 million ($206 million) in 1957 compared with Lire 90,000 million in 1956. Sectors benefiting were petrochemicals, plastics materials, synthetic detergents, nitrogenous and complex fertilisers, sulphuric acid and chlorinated ethylene derivatives.

Prices have shown a tendency to fall. In particular, nitrogenous fertiliser prices have been reduced, and also plastics materials.

Italian imports of chemical products remained relatively stable in 1957 at $184 million. Of these 27% came from Western Germany, 25% from the U.S., 13% from the U.K. and 8% from Switzerland and France. Imports of inorganic chemicals rose by 28% to $25 million.

Exports rose to $160 million compared with $155 million in 1956. Organic chemicals and pharmaceutical products showed most progress. In both cases exports increased 23% on the previous year.

In the first half of 1958, imports of chemicals amounted to $108 million, compared with $86 million in the same period of 1957. Exports totalled $102 million, 24% more than in the same period of 1957.

Belgo-Luxembourg Economic Union. Turnover of the chemical industry in the B.L.E.U. is estimated at B.Frs. 26,000 million in 1957, compared with B.Frs. 25,250 million in 1956. Production rose by about 3% in 1957 as against 7.5% in 1956.

The labour force in the B.L.E.U.'s chemical industry rose by 5%, compared with 1956 and totalled 50,600 persons. 14,300 managerial and other levels and 36,300 operatives.

Chemical industry investment amounted to Belg. Frs. 2,100 million ($42 million) in 1957 as against Belg. Frs. 1,900 million in 1956. Expenditure on new plant and extensions took Belg. Frs. 1,275 million while Belg. Frs. 825 million was spent on replacements and modernisation.

Imports of chemicals rose from $179 million in 1956 to $207 million in 1957, an increase of 15%. Exports rose from $241 million in 1956 to $260 million in 1957—an increase of 8%.

In the first half of 1958, chemical imports totalled $105 million, and exports $139 million, compared with $103 million for imports and $129 million for exports in 1957.

B.L.E.U. Imports

	Increased by $ million
Organic chemicals	4.2
Medicinal and pharmaceutical products (e.g., antibiotics)	12.5
Potash fertilisers	6.7
Plastics materials	3.2
Perfumery, soaps and cleansing materials	2.7

B.L.E.U. Exports

	Increased by $ million
Coal tar derivatives	2.7
Medicinal and pharmaceutical products	2.8
Phosphate fertilisers	2.9
Potash fertilisers	9.5
Complex and mixed fertilisers	1.1
Explosives	2.1
Plastics materials	1.2
Photographic materials	4.5

Netherlands. In 1957 turnover amounted to Fl. 2,030 million (Fl. 1,860 million in 1956). The year is described as a particularly favourable one for the chemical industry. Production rose by 8% compared with 5% in 1956. The index of production was 133 in 1957 compared with 123 in 1956. For 1958 as a whole a 3% increase in chemical production is expected.

The Netherlands' chemical industry labour force rose by 4% (55,500 as against 53,300). Investments in the country's chemical industry are not published. Large investments were made, however, in petrochemicals, nitrogenous fertilisers, sulphuric acid and pharmaceuticals.

Two producers have converted their sulphuric acid plants to use sulphur, instead of pyrites, and a third will shortly be converted.

Plans to extend production of chlorine and caustic soda are at an advanced stage. A synthetic glycerine plant and a polythene plant came into operation in 1958. A new plant for the manufacture of soda ash to cover domestic requirements is planned. Chemical exports rose by 22% in 1957 compared with the 12% in the two previous years. Exports to non-member countries were important while exports to O.E.E.C. countries "continued to develop favourably." Sectors where progress was made included organic chemicals (+9%), paints and pigments (+41%), pharmaceutical products (+34%), fertilisers (+27%). Exports at nearly $139 million were 4% higher during the first half of 1957 than in the same period of 1957. Imports of chemicals in the first six months of 1958 were 5% lower than during January-June 1957. Imports of fertilisers were 18% higher than in the first half of 1957.

Austria. Austrian chemical industry turnover is estimated at Sch. 4,800 ($185 million) in 1957 (Sch. 4,300 million in 1956), an increase of 12% against 13% in the previous years. Labour force employed increased by 4% in 1957 compared with the 12% in 1956 and amounted to 29,000, of whom 7,200 were managerial and technical, etc., and 21,800 operatives.

Figures are not available regarding investments in the industry. No new plants came into operation in 1957, and activities have been limited to modernisation and extension of existing factories.

Foreign trade in chemicals, while still increasing rapidly, rose less in 1957 than 1956. Imports increased by 18% (20%) and exports by 16% (30%). Imports from the dollar area rose by nearly 60%, and pharmaceutical and medicinal products imports increased by nearly 45% in 1957 on 1956.

Geigy's Radiation-Resistant Plastics

ELASTOMERIC materials used for flexible sheathings and coverings in the construction of atomic power stations and laboratories have to operate at somewhere near ordinary temperatures (0° to 30°C) under gamma (and other) radiations from nearby radioactive materials. The behaviour of plasticised polyvinyl chloride under intense gamma radiation was recently investigated by the Atomic Energy Research Establishment in conjunction with The Geigy Company Ltd., and the report on this joint work (A.E.R.E. Report No. E/R 2518: "The Degradation of Plasticised PVC Compositions under High Level Gamma Radiation") showed that the useful life of the PVC is markedly affected by the type of plasticiser used, the best of those so far examined being tritolyl phosphate (TTP; formerly called tricresyl phosphate).

Geigy now report that they have compared the behaviour of TTP with that of their trixylyl phosphate (TXP) and have found no significant difference between the two in respect of radiation resistance. TXP can thus be used in place of TTP in this field—a fact of interest in view of the economic advantages offered by TXP.

The comparison of TTP with TXP was made under conditions similar to those of the earlier investigation, except that the composition used contained 35% of plasticiser (instead of 40%) and the test material was exposed to radiation from spent reactor fuel (instead of cobalt 60). The specimens were all slightly bleached at 1.1×10^7 rads, and blackened at 1.1×10^8 rads.

Each figure in the table below is the average from eight specimens.

Gamma Radiation Dose	*Tensile Product*	
	TTP	*TXP*
None	5.7	5.9
1.1×10^7 rads	5.8	6.3
1.1×10^8 rads	4.9	4.6
s.s.d.*	0.7	0.7

* s.s.d.—The smallest significant difference calculated on 42 degrees of freedom, at the 95% level, is 0.7; any smaller difference could be due to experimental error.

Monsanto May Lay Off Workers

Monsanto Chemicals Ltd. state that it may be necessary to lay off a number of workers at their Cefn Mawr, Ruabon, factory in the near future.

Notices on boards at the factory, which employs 2,000 men, read:

"Increasing competition in the markets in which we sell our products have made it necessary to review further the operation now being carried out with the object of reducing our costs of manufacture."

★ CAN packaging materials of coloured polythene be used with complete safety for foodstuffs? This question is dealt with in a recent issue of *Verpackungs Rdsch* 9, **520**, 1958. Mr. M. Fohr, the author, states that the converter should specify when non-toxic inks are required.

With coloured polythene if complete homogeneity has been achieved, the pigment particles will be completely embedded in the material. The polythene should not in any way be stretched or subjected to temperature changes, so that the molecular structure is disturbed. Tests with sliced apples showed how a chemical reaction from the apples can cause the polythene to deteriorate and even split. Thicker film is said to offer better protection.

★ BECAUSE the problem of safety for workers in industry has been accentuated by new techniques, processes and materials, manufacturers of industrial safety (personal) equipment are in the process of forming a special association. Its objects will include the improvement of standards in the design and construction of such equipment and the promotion of education on its uses.

A meeting is to be held on 17 February at the National Union of Manufacturers, 6 Holborn Viaduct, London E.C.1, at 2.30 p.m. to which all concerned with the manufacture of this type of equipment are invited. A draft constitution will be submitted which on adoption will enable the association to be formed and to start operations.

The programme planned by the new association could have a considerable effect on accident reduction in the U.K.

★ A FINE example of co-operation between the British engineering and chemical industries, quoted in the latest issue of I.C.I.'s *Billingham Post*, is the speed with which repair work has been carried out on two compressors in Ammonia Works which were so badly damaged in a breakdown last August that they have had to be almost completely rebuilt.

Recently the last of a great number of loads of machinery arrived at Billingham from Peter Brotherhood Ltd., to complete the repair of the second compressor, the first having already been recommissioned. As each machine weighed about 100 tons, the task of rebuilding has been formidable.

No patterns were available from which moulds and new castings could be made, but within 48 hours of the second failure, pattern-makers at Peter Brotherhood had cut short their holidays to start round-the-clock working to make new patterns. The company's foundrymen made a similar all-out effort. One of the machines was rebuilt and working in little more than five months of its failure.

Mr. C. S. Tanner, Ammonia Works engineer, said that the co-operation and help received in the emergency was typical of the assistance that "we get from British engineering industry when our needs are appreciated. It is nothing new."

★ ANNUAL savings in maintenance estimated at £3,500 to £5,000 are reported by a Swiss manufacturer of maintenance coatings who has been conducting laboratory tests followed by actual service tests on the value of Hypalon synthetic rubber, produced by E. I. Du Pont de Nemours and Co. Inc., Wilmington 98, Delaware, U.S.

A striking example of the saving involved by using Hypalon coating is that of a kettle, used to salt out a dye compound, which holds a brine of 20% sulphuric acid with a content of approximately 3% sodium chloride. Temperature of the brine is 95 to 98°C, and the lead cooling coils are inserted after the compound is salted out. Attack by hydrochloric acid and abrasion against the dye crystals previously caused failure of the lead pipes after 20 to 40 cycles. Additional expense resulted from contamination of the dye compound by lead sulphate, which had clogged the suction filter bottom during the subsequent filtration.

Three coats of a Hypalon maintenance coating were applied to the lead pipes after sanding and priming. The elastic coatings, approximately 0.2 mm. thick, have been found to protect the coils against chemical attack and mechanical damage. One coil, it is reported, was in good condition after 100 cycles, and that another developed easily repaired blisters after 110 cycles. Lead mud no longer contaminates the dye, and faster filtration offsets the slightly longer cooling period.

★ I WONDER how many chemical manufacturing companies have found that when they have first introduced method study in their organisations, the results have come as a bit of a shock. Dr. C. F. R. Harrison, work study manager, Imperial Chemical Industries Ltd., Witton, addressing members of the British Institute of Management who attended the B.I.M. conference at Harrogate last week, said that I.C.I. had found that the rate of working was often much lower than it was thought to be, and perhaps even more surprising was the discovery that in many cases they were paying men for walking far more than for working. When only a very low rate of working was possible the cause could usually be traced back to the original design of the plant—layout, access and the correct placing of control instruments. The study of methods was then carried back to the design office, which was now using new methods—chiefly the employment of three-dimensional scale models. The scope and precision of this technique had reached a stage when it bid fair to revolutionise drawing office methods for the chemical industry, it was suggested.

In order to live in a materialistic world in which there is growing industrial competition from China and Russia, not to mention Japan and Western Germany, it is necessary to raise industrial efficiency and get the best out of everyone in industry. Our standard of living, as Dr. Harrison pointed out, depends on our ability as a nation to compete successfully in world markets. Therefore, we need to make the best of all our resources—manpower, labour and management, materials and capital equipment, and the most fundamental and important is manpower.

★ AFTER 14 months in acid service, 40 zirconium-stemmed control valves are still operating without a single stem failure, Mallory-Sharon Metals report. The valves are used in all concentrations of hydrochloric and sulphuric acid, raffinate, acidified hexone, solutions of ammonium thiocyanate and thiocyanic acid. Very little maintenance or operator attention has been required.

Designed by a Mallory-Sharon instrument engineer the valves were custom-fabricated using zirconium sponge. Although initial cost was not a factor in this instance (U.S. Industrial Chemicals Co., Mallory-Sharon's parent company, produce zirconium) the extremely long life of the material, and the freedom from maintenance problems, have proved that zirconium is very economical in the long run in applications where lower-priced metals do not stand up to the conditions.

Costs of zirconium are now being gradually reduced as more of the metal becomes available to industry. In the U.S., fabrication of zirconium parts at costs only 3 to 5 times higher than for equivalent parts in stainless steel are foreseen. The improved performance with zirconium alone is considered to more than offset the cost differential.

Alembic

DEVELOPMENTS IN CORROSION PROBES

Shell Research Develop Radioactive Probe at Thornton Heath

WITH the development of high efficiency steam boilers, the temperature of gases passing to the stack has steadily decreased, and metal temperatures, particularly in economisers, air heaters, and chimneys, are frequently so low as to lead to the condensation of corrosive substances. A metal specimen at a controlled temperature has been exposed to the actual flue gas, so simulating a boiler component, and to measure the corrosion rate.

On the advice of R. W. Kear (Shell Petroleum Co.) who had been associated with the use of corrosion probes at the British Coal Utilisation Research Association, a suggestion that radioactivation techniques might be utilised in measuring corrosion probes was taken up. Shell Research Ltd.'s Thornton Research Centre, Chester, undertook to develop a prototype radioactive probe.

Design and Performance

A paper read to the Institute of Fuel on 4 February by Dr. D. Anson, of the Shell Thornton Research Centre, described the design and performance of such a probe. The object was primarily to reduce the time needed to complete a measurement, by using short exposure times and a rapid or even continuous method of analysis.

The design. The actual mild steel test piece (1¼ in. long × ½ in. outside dia. of 0.010 in. thickness) is supported at its ends; which locate loosely in annular groves in the back plate and cap nut (of Monel metal), and is clamped between these members against asbestos packing. A four-legged spider, machined integral with the central tubular member serves to carry four thermocouple wires (iron/Constantan) and to press these against the inside of the test piece, individually, near the extremity of each leg. The hot junctions are maintained only by pressure of the wires on to the mild steel test piece.

Temperature control is by a regulated stream of cold air passing up the central tube, emerging to the inside of the test piece through four radial holes, and returning via the annular space between the central tube and test piece or outer casing to atmosphere. The irradiated test piece can be fitted to the remainder of the assembly by slipping it over the thermocouple spider and screwing the cap nut in place, ensuring the test piece is correctly located. Tongs and a special box spanner are used to carry out the operation.

Temperature Measurements. The relation of the recorded temperatures to the true outer skin temperature of the test cylinder has not been established in the tests carried out, and will depend, Dr. Anson stated, on the flue gas temperature and velocity, as well as on conditions within the probe. Where temperature differences between the flue gas and probe of the order of 50 to 100°C, and low gas velocities exist, suitable corrections could be applied.

Preparing the Probe. Where the test piece had been exposed to the atmosphere for some time before the test, a high iron loss was noted at the end of the test (probably due to the inclusion of atmospheric corrosion products in the washings). After the initial test, consistent results were observed so long as the probe was in continuous use, suggesting that preparatory polishing of the surface was unnecessary. In later tests the probe was washed by dipping six times in hot distilled water at about 90°C, followed by flushing with distilled water and finally acetone to assist drying.

Procedure. A technique was described by Dr. Anson for assembling the radioactive probe. The test period was of 10 minutes duration in which time accurate results could be obtained. Response of the test piece to temperature regulation was stated to be very rapid and manual control was easy. At the end of each run the probe was removed from the gas stream, washed by dipping six times in distilled water and flushed lightly with distilled water, all the washings being kept for analysis. Using radioactive techniques, loss by evaporation is stated not to be detrimental as the solutions are made up to standard volume.

Analysis of Samples. Radioactive iron (^{59}Fe) content of the washings from the corrosion probe is determined by measuring its activity above the normal background count. Counting has been carried out with a standard volume of 10 ml. of the washings in an annular cell surrounding a thallium activated sodium iodide crystal, type Ekco N.553, in conjunction with a scintillation counter.

By refining the probe washing techniques the volume of water used was reduced to 25 ml. A rate of 50 counts per minute or less could be used so reducing counting time to 2 minutes, with no loss of accuracy.

Results. Samples of solution taken for radioactive assay are stated to be much less susceptible to contamination than are similar ones taken for chemical analysis, since even the presence of iron salts other than those from the specimen will not affect the radioactivity of the sample.

The radioactive levels required do not introduce any appreciable health hazard. The requirement that the total mass of radioactive test piece should be kept small to reduce its total activity introduces difficulties in ensuring even temperature distribution, but allows a marked improvement in temperature control.

Use of a radioactive element on the corrosion probe has resulted in a great reduction in the times needed for both exposure and analysis, with no loss in accuracy. Ultimately it is hoped that a completely automatic device can be developed, in which exposure and washing of the probe, analysis of the washing and recording of the result can be completed in a cycle taking a matter of minutes.

Constant Temperature Probe Can be Used for Long Periods with Little Attention

A SIMPLE corrosion probe capable of operating at constant temperatures for long test periods with a minimum of service or attention was detailed by R. W. Kear, Oil Products Development Department, Shell Petroleum Co. Ltd., at a meeting of the Institute of Fuel held in London on 4 February.

Techniques at present available for assessing flue-gas corrosion could be classified into one of two groups. In Group I were those techniques which aimed at providing in a short time a relative or indirect assessment of flue-gas corrosion using such instruments as the dewpoint meter, probes employing the principle of voltaic cell, and air-cooled corrosion probes. Of these methods the dewpoint meter was probably the most widely used. With this instrument and the principle of the voltaic cell, difficulties arose with the interpretation of results. For this reason the air-cooled corrosion probe technique was preferred since it provided a direct assessment of corrosion. The short duration of the tests, however, meant that in many cases, results were only relative and the need to carry out an analysis of the probe washings to determine the iron corroded rendered the method rather time-consuming. Any attempt to extend the period of testing would mean sacrificing the simplicity of the air-cooled probe.

Group II included those techniques of which the object is to determine the concentration of the corrosive agent present in a flue gas or to assess directly the corrosion occurring on boiler surfaces. Much attention had been devoted to developing chemical methods for the direct determination of the amount of SO_3 in a flue gas. The methods developed

so far demanded skilled attention.

Removal by scraping of a known area of corrosion products from the corroded surface and determination of the iron content of the scrapings was restricted to those areas which were accessible to scraping. Due to the build-up time required, some of the corrosion products could be swept away in the gas stream.

Belgian workers were using a gas chromatography method in an attempt to assess the rate of boiler corrosion by measuring the hydrogen released by flue gas from the corrosion reactions. There were many difficulties associated with this method and it was too early to determine to what extent it might be useful in assessing flue-gas corrosion.

Of all these techniques, it was considered that the air-cooled corrosion probe provided the most promising line of approach to the design and development of a suitable field instrument. Several prototypes were produced. In the finalised one, the Mark IV, a probe of improved design was constructed in which the cooling surface of the internal condenser was enlarged and the external condenser dispensed with. The test piece was simplified to consist of an open cylinder 20 in. long by 2 in. overall diameter.

Carrying out a test. Procedure adopted for carrying out a test is as follows:

(1) The selected sampling point should allow the probe to be inserted into the gas stream and not a stagnant pocket. The probe fixing collar is welded to a 4 in. diameter hole.
(2) The test piece surface is prepared with grade O emery paper, degreased and washed twice with acetone. Test piece is dried and weighed to nearest 0.1 g.
(3) Test piece is fitted to probe.
(4) An appropriate quantity of coolant to fill test piece is poured into the probe through the catch tank connection (1 l. for test piece 20 in. × 2 in.).
(5) Inlet and outlet water hoses are filled and water supply is adjusted to about 100 gall./hr.
(6) Probe is inserted into boiler and catch tank filled.

At the conclusion of a test, the above sequence is reversed thus:

(1) The catch tank is removed as is the probe, which is allowed to cool.
(2) Water hoses are removed, coolant is drained off and volume measured (to indicate if probe has functioned correctly). If no coolant is present this may point to a leaky seal or failure of water supply. In either event control of the test surface temperature will have been lost.
(3) Soot is wiped off probe and test piece is detached.
(4) Test piece is immersed in a drum of hot water containing a suitable amount of corrosion inhibitor (1 oz. I.C.I. Stanning R.T.A. pickling restrainer in 10 gall. of water) and washed thoroughly.
(5) Test piece is washed in clean water and rinsed twice with acetone, then dried thoroughly and weighed to nearest 0.1 g.

Tests carried out. The Mark II probe was inserted into the flue of a 45,000 lb./hr. John Thompson boiler at Stanlow Refinery at a gas temperature of 600°F, the test temperature being controlled at 241°F using methyl isobutyl ketone as coolant. The coolant, however, spurted from the open end of the condenser. When the probe was refilled and re-inserted at a gas temperature of 350°C, to overcome this build up of vapour pressure, an internal primary condenser was inserted into the main body of the probe to condense most of the vapour. This modification was used in the Mark III probe.

Results. Models Mark III and IV have been in use for a limited time at a number of C.E.G.B. stations and experience had confirmed that the probes functioned satisfactorily, were easy to use, and required little or no attention during operation, reported Mr. Kear. A further advantage would accrue if it were possible to eliminate the need for a continuous supply of cooling water. The value of an air condenser deserved further investigation and future work was contemplated on the design and development of a probe to operate independently of any services.

The choice of liquids as coolants was not very restricted. Almost any hydrocarbon having the required boiling point would do provided that it did not corrode the internal surface of the test piece and was thermally stable over prolonged periods of refluxing. Suitable coolants used to date over a temperature range from 104° to 338°F were: methyl chloride, chloroform, methyl ethyl ketone, sec. butyl alcohol methyl isobutyl ketone, methyl oxitol, ethyl oxytol and isopropyl oxitol.

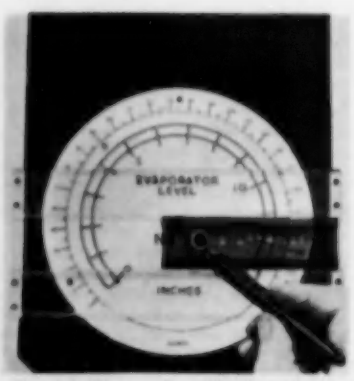
Preheating the probe to the boiling point of the coolant before inserting into the flue gas would overcome the difficulty associated with the short period elapsing while the test surface attains the working temperature. (During this period uncertain corrosive conditions exist.) Mr. Kears therefore suggested preheating by means of a detachable electric sleeve placed over the test surface or by an internal electric heater fitted as an integral part of the probe. This latter method of preheating, it is considered, might provide a useful technique for carrying out corrosion tests at temperatures above that of the flue gas.

Device for Calibrating Dials

A DEVICE providing an easy means of labelling and calibrating blank dials for 3-15 p.s.i. receiving pressure gauges has resulted from a suggestion by an instrument chargehand at I.C.I. Billingham. These gauges are widely used in industrial processes to respond to the output of transmitting instruments which may measure, for example, 0-40 tons, −30° to +30°C or 0-300 M³/hr.

The device consists of a sheet plastics baseplate to which is fitted a plastics disc subdivided into 0-270 degrees. The blank is fitted flush into the disc, which has been cut away in the centre and screwed down at two points.

A radial arm is then screwed into the centre. Holes drilled at intervals along the arm enable the point of a stencilling pen to be pushed through to the dial and circular arcs to be drawn. The radial calibrating marks are drawn along the edge of the arm at the appropriate angular settings.



The labelling and calibrating device. (Photo by courtesy of 'Target')

A pair of transverse arms, made of clear plastics, are fitted across the plate. These move freely up and down the plate and can be held in any position by means of a thumbscrew.

A stencil is slid into the space between the arms and the legend and numerals are marked on the dial.

1961 Achema Limited to Same Size As Last Years

THE Achema exhibition and congress of chemical engineering will be held in Frankfurt from 9 to 17 June 1961. It will once again include the following groups of exhibits: research and literature, new chemical substances, nuclear science and techniques, laboratory techniques, measurement control and automation techniques, structural materials techniques, works techniques, pumps and fittings, packaging techniques, auxiliary materials and consumable stores, accident prevention and works safety precautions.

The Achema congress 1958 required the whole of the Frankfurt exhibition grounds consisting of 700,000 sq. ft. of floor space in 15 halls as well as 86,000 sq. ft. in the open. So many applications for stand space at the 1961 congress had been received by the beginning of December that a total floor space of about 970,000 sq. ft. would have been necessary.

To avoid the possibility of endangering the success of the exhibition, it has been decided to keep within the previous limits. This means that applications for stand space which have already been received will have to be reduced to accommodate all exhibits within the space available.

Humglas Acquire Exclusive PEC Licence for Fertiliser Processes

EXCLUSIVE licence covering the U.K. and Eire for the complex fertiliser processes of the French firm Potasse et Engrais Chimiques has been granted to Humphrey's and Glasgow Ltd., London.

Financial advantages claimed for the processes are big savings in sulphuric acid and low capital cost compared with total investment for producing complete fertilisers.

Plants using these processes are already in operation in France, Germany, Sweden, Finland, Formosa, and the U.S. Another is being brought on stream at the £30 million A.N.I.C. synthetic rubber and fertiliser plant at Ravenna, Italy.

In the French processes, phosphate rock is acidulated with nitric acid. The resulting slurry is neutralised with ammonia, with precipitation of dicalcium phosphate. The remaining calcium nitrate is converted to an insoluble calcium salt, eliminating the filtration required in many other processes. In these processes, the vacuum filters and pumps always require great care to operate and maintain in good order.

Calcium nitrate conversion is carried out by the use of one of the following:

(1) SO_4 ion (in the form of sulphuric acid or ammonium sulphate or potassium sulphate).
(2) PO_4 ion (e.g. in the form of phosphoric acid) and
(3) CO_3 ion (in the form of carbon dioxide in the presence of a stabiliser).

The most economical process is that using the CO_3 ion, as apart from the raw materials supplying the fertilising elements (phosphate rock, nitric acid, ammonia, and eventually a potassium salt), only ordinary carbon dioxide and a small amount of magnesium salt are required.

Cost of the magnesium salt is almost negligible and, in general, when the PEC plant is situated in the vicinity of an ammonia synthesis gas generation plant the carbon dioxide, which is normally rejected to atmosphere, can be considered as without cost. The calcium carbonate is derived from the calcium of the phosphate rock and the carbon dioxide, avoiding the necessity for the supply of suitably crushed chalk.

The ideal situation for a plant using the French processes would be near an existing fertiliser factory where adequate supplies of carbon dioxide, ammonia and nitric acid are available.

The PEC company has designed standard equipment making it possible in a single plant to use any of the processes listed above or even to combine them. This gives the producer considerable flexibility for meeting the various formulations requested by the farmer.

All the processes, it is claimed, offer the following two financial advantages: Phosphate rock is dissolved by nitric acid (the acidity of which would be required in any case), instead of sulphuric acid. This results in a saving of 2 to 3 tons of sulphuric acid per ton of soluble P_2O_5. Capital cost is low compared with total investment for producing complete fertilisers, which would involve a sulphuric acid plant, an ammonium sulphate plant, a superphosphate plant, and plants for mixing, granulation and drying.

Fertiliser produced by the French processes is granulated and dried in the normal way to give a non-hygroscopic granular product which can be stored indefinitely.

For the farmer, the fertiliser is backed up by systematic farm tests which have given very good results over some 20 years. The phosphate is available in the fertiliser as citrate-soluble material. Agronomists in America and Europe consider that equal effects are produced by phosphate in the water-soluble or citrate-soluble forms.

Woodall-Duckham Licensed to Build Reforming Plant to Produce Town Gas

A LICENCE to exploit a new process for reforming refinery and liquid petroleum gases and light distillate to produce town gas possessing completely interchangeable characteristics has been acquired by Woodall-Duckham Construction Co. Ltd. Known as the 'MS' process, it was invented by Stein et Roubaix, of Paris, and was developed jointly with Gaz de France. A commercial plant has been operating for the last two years at Sete, France, and several other installations are in operation or in the course of erection on the Continent. With the acquisition of this licence, Woodall-Duckham are in a position to project schemes and build plants in the British Commonwealth, Eire and Scandinavia.

High calorific value gaseous and liquid hydrocarbons obtained from refinery gases (chiefly propane and butane, refinery tail gases and light distillates) can be converted into town gas of acceptable combustion characteristics. This can be accomplished by an endothermic process, utilising the chemical effect of steam in the presence of a catalyst.

In order to produce a gas containing at least 40% of hydrogen, the addition of a 'water gas' reaction is necessary. If steam is added to the process mixture in the presence of a catalyst, the reaction $C_3H_8 + 3H_2O = 3CO + 7H_2$ occurs. The heat for this reaction can be supplied either by internal combustion or by introducing a heat phase cyclically into the operation. The 'MS' process combines these two sources of heat production in varying proportions in order to produce a cracked gas having the desired characteristics.

Cyclic reforming requires close control to obtain optimum results and to avoid incorrect cracking conditions. Any variation in the flow of gas, air or steam can upset the temperature of the catalyst bed, leading to faulty cracking. To eliminate this drawback, the 'MS' process was devised, in which control of the cycle is achieved pyrometrically.

The plant consists essentially of a single shell generator, carrying the catalyst bed, a water seal (wash box) and a direct washer scrubber. The complete cycle is divided into four phases—heating, steam purging, gas making, and steam purging. It is reported that the plant can be brought into operation from cold within a few hours. Efficiency of reforming a gaseous feedstock to a calorific value of 475/500 B.T.U. is stated to be between 85 and 87% depending on feedstock.

Shell to Install Polyolefin Plant at Carrington

CONSTRUCTION is to be started of large scale polyolefin manufacturing facilities by Shell Chemical Co. Ltd. at the Petrochemicals Ltd.'s works at Carrington, near Manchester. Some 30,000 tons a year of polythenes and polypropylenes will be produced. High-density polythene will be manufactured under the exclusive Ziegler licence for the U.K. which was acquired by Petrochemicals Ltd. Polypropylenes will be manufactured using a Shell process based on Ziegler and Natta's work on this polyolefin.

Starting material will be light naphtha obtained from Shell's Stanlow refinery. At present, this raw material has been transported to the pilot plant at Petrochemical's works by barge on the Manchester Ship Canal. This spring laying of pipelines from Stanlow (25 miles away) will be begun. The plant is scheduled to be in operation in 1961.

The company also state that the Partington Works of Petrochemicals Ltd. will in future be known as the Carrington Works.

I.I.S.O. Lecture on Prevention of Industrial Accidents

Mr. R. E. Tugman, president of the Institution of Industrial Safety Officers, will give the first Alexander Redgrave Memorial Lecture at the Royal Society of Arts on 26 February. His subject will be the responsibility of management for the prevention of industrial accidents.

Before he retired in 1958 Mr. Tugman was division safety officer of Imperial Chemical Industries Ltd., Alkali Division.

Analytical Chemistry of Co and Ni

A. J. Brookes Discusses Recent Trends at Midlands S.A.C. Meeting

IN the nature of a review of some of the more interesting and important aspects of the subject was a recent discussion meeting on 'The analytical chemistry of cobalt and nickel', held by the Midlands Section, Society for Analytical Chemistry, in Birmingham, which was opened by Mr. A. J. Brookes (Henry Wiggin and Co. Ltd.).

Nickel, cobalt and their alloys were today found in a very large number of applications. Some of these alloys were extremely complex and a full treatment of their analysis would fill a text book. On the one hand the manufacturer had no shortage of solid sample and chemical analysis was used in conjunction with instrumental techniques, which took most of the burden when properly standardised. On the other hand the valve manufacturer might be interested in one particular cathode weighing as little as 10mg., and it was from workers in this field that many significant improvements in analysis of pure nickel had come.

Both nickel and cobalt were found commercially in a wide variety of sizes, from fine powders to wrought and cast products. The powders were very reactive and picked up oxygen and nitrogen from the atmosphere. In addition, both metals were extensively used in the form of salts, notably in plating, pottery and agriculture.

Soluble in Nitric Acid

Both metals were readily soluble in nitric acid, although nickel could easily be made passive if the strength used was much greater than sp. gr. 1.2. Both metals, in the form of powder or very fine millings, could be dissolved in hydrochloric and sulphuric acids. Any nitrides present were converted to ammonia and could be determined by alkaline distillation. A mixture of bromine in hydrobromic acid was a useful solvent when silicon was present together with tin, as in graphitic nickels. Evaporation would then remove the tin and leave a clean silica.

A mixture of nitric and hydrofluoric acids was very useful for dissolving high-silicon materials, silicon being separated as silicofluoride. When the chromium content rose to over 2%, aqua regia was necessary to effect solution. For alloys containing chromium and over 1% carbon, a mixture of perchloric and phosphoric acids was ideal for breaking down the carbide.

Two useful solvents of a less active kind were often used. A solution of bromine or iodine in dry ethyl acetate would dissolve the metallic portion of a finely-divided sample and leave inclusions etc., undissolved. A solution of copper ammonium chloride made slightly acid with hydrochloric acid was used to concentrate carbon and sulphur contents, since these elements remained in the residue.

Both metals would burn in oxygen. The powders burned readily and unaided at about 800°C, but heavier material might need a flux, such as lead or tin, at 1,000°C to complete oxidation. Although carbon recovery was complete, sulphur recovery only approached 100% at temperatures above 1,350°C. In the case of the more refractory alloys these temperatures might need raising by 200°C, together with carbon- and sulphur-free iron powder as accelerator.

Both carbon and sulphur were of great importance at levels below 0.01%. Mr. Brookes and his colleagues had built, quite cheaply, a carbon apparatus which was a cross between the Strohlein and Haldane types. This combined convenience and speed of the Strohlein with accuracy and stability of the Haldane. Using a 2.5g. sample, reproducibility was 0.001% and, if suitable heating was available, total analysis time could be reduced to 5 minutes. For sulphur determinations the acidimetric finish was preferred, using similar materials analysed gravimetrically as standards.

If high-frequency heating were used, actual power input to the sample would need to be up to ½ kW, preferably at 5 megacycles. This frequency was the lowest that would satisfactorily heat fine drillings, and it would still cope with a lump sample.

Reduction of Oxides

Oxides of nickel and cobalt were reduced by hydrogen but, since wrought products usually contained elements whose oxides were not reduced by hydrogen, this method of oxygen determination had its limitations.

Inorganic salts of nickel and cobalt were, in general, soluble in dilute acid and showed characteristic colours. Nickel salts exhibited a pronounced green colour under all conditions, but cobalt solutions were a deep magenta colour, except when the hydrochloric to water ratio was high, the colour then changing to a deep blue. These colours had a marked bearing on direct photometric determination of the elements present. In some cases, e.g., determination of silicon as molybdenum-blue, the test was sufficiently sensitive to overcome the background colour of nickel or cobalt present, the bottom limit of detection being around 0.002%. In other cases, e.g., determination of chromium with diphenylcarbazide and of manganese as permanganate in cobalt, separations were necessary.

Direct methods that had been used with success on pure nickel included iron and titanium by means of Tiron, manganese by periodate or persulphate, chromium by diphenylcarbazide after oxidation to chromate, and cobalt by nitroso-R salt or 2-nitroso-1-naphthol.

Separation by extraction had been necessary when determining copper by diquinolyl or dithiocarbamate, aluminium and magnesium by hydroxyquinoline, phosphorus by vanadomolybdate, and cobalt by thiocyanatetetraphenylarsonium chloride.

Importance of cobalt contents of less than 0.05% had been emphasised by atomic energy requirements and the practice of Mr. Brookes and his colleagues had been to concentrate by 1-nitroso-2-naphthol, using a little iron as carrier.

In acid solution both nickel and cobalt showed remarkable stability, being completely unaffected by all normal strong oxidising and reducing agents, such as persulphates and perchlorates on the one hand and titanous chloride and hypophosphites on the other.

Determining Sulphur

Sulphur had been determined by reducing sulphate to hydrogen sulphide by means of hypophosphite-hydriodic acid. Final determination might be made by means of oxidimetric titration, indirect polarography or photometrically.

In ammoniacal solutions nickel was soluble and stable in the divalent state. Cobalt was, however, soluble and very easily oxidised, even by air, to the trivalent state. Use of potassium ferrocyanide as titrant, coupled with a potentiometric end point, constituted probably the most satisfactory method for determination of large amounts of cobalt. Only manganese interfered, titrating exactly as cobalt, so that a correction might be applied. Both nickel and cobalt were soluble in ammoniacal carbonate, phosphate and oxalate solution.

Sodium hydroxide precipitated nickel as pale green flocculent hydroxide and cobalt as pink flocculent hydroxide. These precipitates were too bulky to be of use for separation but could be oxidised by bromine to very dense, dark trivalent hydroxides. At one time this had been a popular method in determining small amounts of chromium in nickel and cobalt.

Nickel and cobalt were readily removed from dilute sulphuric acid solution using a mercury cathode. If a solid sample was available, it was possible simultaneously to dissolve and remove the metal. Under these conditions the strength of acid could be reduced appreciably. For example, using only 20ml. of 1 to 2,000 sulphuric acid, 1g. of metal could be removed in 1 hr. with only 12v potential and 2 sq. cm. of anode surface. This separation was of great

value for determination of such elements as aluminium, rare earths, calcium, magnesium and boron.

A number of other elements would follow cobalt and nickel into the mercury and, for more specific separations, organic precipitants were more useful. The nickel dimethylglyoxime and cobalt 1-nitroso-2-naphthol compounds were readily soluble in chloroform and carbon tetrachloride. Except for palladium, nickel separation was specific, but cobalt separation also removed iron, copper, some chromium and other minor elements. Even so it was of great value in determination of small amounts of nickel and manganese in cobalt. The colour of the alkaline cobalt solutions was too deep for normal colorimetric nickel determination and, in addition, the cobalt-amine combined with dimethylglyoxime to form a complex, so until excess reagent was added no precipitation of nickel occurred. Another method of separating cobalt, still used for determination of large amounts of cobalt, was precipitation as potassium cobaltinitrite from dilute acetic acid solution.

Formation of double cyanides, a feature common to both nickel and cobalt, was useful for suppressing interference and also as a method of determination. In this context it had to be pointed out that satisfactory titration of cobalt could only be achieved when the metal was oxidised to the trivalent state. Unlike that of zinc, the double cyanides of nickel and cobalt were stable to formaldehyde.

Use of Polarography

With regard to polarography, in most electrolytes the half-wave potentials of nickel and cobaltous solutions lay fairly close together, e.g. about −1.1 and −1.4 v respectively. This made it difficult to determine small amounts of one metal in the presence of the other. If the cobalt were, however, oxidised to the cobaltic state, the reduction wave for this state occurred at about −0·5v, making possible determination of cobalt in nickel. The fact that the former potentials were fairly low down in the series allowed a number of elements to be determined directly. It was interesting to note that, in neutral or alkaline tartrate solution, nickel showed no reduction wave at all.

Referring to chromatography, under many common conditions the Rf values were very similar. The following solvent mixtures were worth noting. For butanol/N hydrochloric acid the values for nickel and cobalt were both 0.03, while that for zinc was 0.51. For methyl ethyl ketone/concentrated hydrochloric acid (92 + 8) the values were 0.01 for nickel, 0.18 for manganese, 0.54 for cobalt and 0.93 for iron.

Cation exchanger resin was useful for complete separation of all the metal, e.g. when investigating small amounts of sulphur as sulphate. Separations by means of chloro complexes and anion exchanger resin were possible under certain conditions. For example, using 2N hydrochloric acid with the chloride form of Deacidite FF, both nickel and cobalt passed through the column while zinc and cadmium were quantitatively retained and might be subsequently extracted by means of N nitric acid.

In the general discussion which followed Mr. Brookes' remarks, the chairman, Dr. R. Belcher, expressed surprise that no mention had been made of the difficulty of determining nickel in presence of both iron and cobalt. In a very informative paper (Chirnside, Cluley and Proffitt, *Analyst*, 1947, **72**, 351) it had been confirmed that a precipitate of iron, cobalt and dimethylglyoxime, of indefinite composition, was formed. By reducing iron (III) to iron (II) and precipitating in a sodium acetate medium, the iron-cobalt complex was not formed.

Mr. Brookes said he did not know this method but considered it essential to oxidise cobalt (II) to cobalt (III), otherwise it reacted with the reagent. It would be impossible to effect this oxidation and maintain the iron in the divalent condition. A member of the audience confirmed this view and said that he had never heard of the reduction method being used.

The chairman thought there was probably some confusion because he believed that oxidation of cobalt (II) was not essential; so long as sufficient reagent was present to form the soluble cobalt complex, nickel precipitation was not hindered provided that iron was absent.

Dr. S. H. Jenkins inquired if any loss of chromium, as chromyl chloride, would be expected when using perchloric acid to destroy organic matter in which small amounts of chromium were to be determined. Some chloride would inevitably be present with the organic matter. A member of the audience thought that there would probably be some loss. It might be overcome by addition of nitric acid which should remove traces of chloride as nitrosyl chloride.

Max-Planck's Simple Process for Alkylboric Acid Esters

THE following report, by Dr. R. Köster, of the Max-Planck-Institute for Coal Research, Mülheim-Ruhr, appears by special permission in the West German chemical journal *Angewandte Chemie* (7 January, 1959). Dr. Köster notes that in studies on the subject, H. Meerwein and H. Sönke (*J. prakt. Chemie*, 1938, No. 147, p. 252) reported that boron triethyl and boric acid esters did not react with one another. He suggests that their experiments were probably carried out at too low a temperature, as the production of alkylboric acid esters from boron trialkyls and boric acid esters can be brought about in quantitative amounts by the use of certain graduation methods.

By heating a mixture of a boron trialkyl and a boric acid ester (with reaction-partners such as these, both with a low boiling point, this is carried out in closed containers under pressure) to about 200° C and rather higher temperatures, monoalkyl boric acid esters which, thermally, are extraordinarily stable are obtained. This is a contradiction of a report on the subject by P. A. McCusker at the 16th International Congress for Pure and Applied Chemistry in Paris in July, 1957. Thus

$$R_3B + 2B(OR')_3 \rightarrow 3RB(OR')_2$$

Also formed by the reaction are dialkyl boric acid esters.

$$2R_3B + B(OR')_3 \rightarrow 3R_2B(OR')$$

These compounds break down in general into boron trialkyls and monoalkyl boric acid esters.

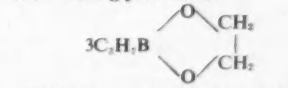
$$2R_2B(OR') \rightarrow RB(OR')_2 + R_3B$$

In some cases, Dr. Köster reports that it is possible to produce pure dialkyl boric acid esters also by reacting boron trialkyls with boric acid esters. At higher temperatures the esters of diethyl boric acid in particular are obtainable in good yields directly from boron triethyl plus a boric acid ester.

Also, from boric acid esters with polyvalent alcohols (e.g. glycol) heated together with boron trialkyls good yields may be obtained of such monoalkyl boric acid esters as the following:

$$[B_2(OCH_2CH_2O)_3] + B(C_2H_5)_3 \xrightarrow{150°C}$$

polymeric glass-type boric acid glycol ester.



With the new production method it has been possible to produce a greater number of pure mono- and dialkyl boric acid esters, as well as several alkylboric acids by a coupled hydrolysis process. A further report will deal in detail with this subject as well as with the related production of arylboric acid esters from boron triaryls and boric acid esters by a graduated process.

Compared with former production methods for alkylboric acid esters from boron trialkyls (M. Lappert *Chem. Reviews*, 1956, **56**, 985 et. seq., sums up the situation up to 1955; since then no basically new methods for preparation of alkylboric acid or its esters have been published), the new process is stated to have the considerable advantage that no boron-connected alkyl groups are lost in production. Compared with the accepted methods associated with boric acid esters (see parenthesis above), the advantage is that the distillation of the reaction product is remarkably simple. No auxiliary materials are needed at all, as is the case, for example, with the production of alkylboric acid esters from the corresponding alkylboric halides by alcoholysis.

Alkylboric acid esters have an interesting use, among other uses, as intermediate material for the production of boric trialkyls. With aluminium trialkyls they react with the changing of ester groups against alkyl groups. For example:

$$3RB(OR')_2 + 2AlR_3 \rightarrow 3R_2B + 2Al(OR')_3$$

Therefore, by the auxiliary use of a graduated reaction the transposition of boric acid esters $B(OR')_3$ plus aluminium trialkyls into boron trialkyls is brought about in two straightforward stages.

Chemist's Bookshelf

'STIMULATING' GAS CHROMATOGRAPHY

GAS CHROMATOGRAPHY 1958. Edited by *D. H. Desty*. Butterworths Scientific Publications, London, and Academic Press Inc., New York. 1958. Pp. xiv + 383. 70s. ($12.00).

It is doubtful in modern times whether there has been any development in analytical chemistry which has progressed as rapidly as gas chromatography. The procedures were only beginning to be developed about seven years ago and yet, today there are very few large analytical laboratories in this country which do not possess the appropriate equipment or do not contemplate its purchase. It is true that most of the developments have taken place in connection with the analysis of organic materials, but the time is surely coming when volatile inorganic compounds will be handled quite readily. In all these circumstances it is not surprising that groups of men and women of very varied interests are gathering together on occasion to discuss the developments in gas chromatography.

'Gas Chromatography' presents the Proceedings of the second symposium organised by the Gas Chromatography Discussion Group under the auspices of the Hydrocarbon Research Group of the Institute of Petroleum and the Koninklijke Nederlandse Chemische Vereniging held at the Royal Tropical Institute, Amsterdam, 19 to 23 May, 1958. It should be said at once that this compilation of 28 papers is really first class and great credit is due to D. H. Desty, the editor, and his helpers. It is quite obvious that they have put in a great deal of work in editing the various manuscripts. The book is divided into three sections which are nicely balanced. The first section deals with the theory of gas-liquid chromatography, the second with techniques and apparatus and the third with applications.

One of the most important features of the book is the inclusion of the relevant discussion on each paper and moreover the appropriate references are appended. The discussions are very informative indeed and show quite clearly the great improvements in both theory and practice in this rapidly developing field. In the first section attention is directed to such varied subjects as the attainment of high column efficiencies with various packings, to the use of coated capillaries in gas chromatography, to the study of sorption isotherms and the determination of activity coefficients. In the second section many types of detector are described including flame ionisation, emissivity, hydrogen flame, argon, katharometer and thermal conductivity. Descriptions are given of different types of column and their mode of use for different purposes. In the final section there are papers dealing with the introduction of automatic methods in gas chromatography and observations are made on the separation of many classes of organic compounds such as volatile halogen compounds, essential oils, petroleum hydrocarbons, phenols and amino acids.

This book is very stimulating indeed and is bound to be a great help to those analysts who are looking ahead and wishing to improve the methods of analytical separation which they employ.

J. HASLAM.

Supplement to Chemical Encyclopædia

THE ENCYCLOPEDIA OF CHEMISTRY (Supplement). Edited by *George L. Clark*. Reinhold Publishing Corporation, New York; Chapman and Hall, London, 1958. Pp. 330. 80s net.

Designed to supplement the original Encyclopedia, this present volume adds more than 200 articles to those covered originally. The high standards of the original work are maintained. It is noticeable, however, that physics and chemistry can no longer be clearly separated, in particular, the chemistry of nuclear phenomena, for example plasma, jet propulsion, radiocarbon determination, radiation biochemistry.

The arrangement of the supplement is identical to that of the parent book: articles appear alphabetically by subject and each is written by a respected authority in science and/or industry. The diversity of the topics again covered is most impressive and the work must undoubtedly be a valuable source of information and reference.

A warranted criticism of this work is the finding that references in this Supplement to other articles are not clear, that is, the articles referred to may be included in the Supplement or in the original Encyclopedia. It should have been possible to include a note of the page in the original work in the present Supplement. For example, the cross reference for propellants in the Supplement is 'Fuels'. The article on 'Fuels' is in the original work.

It is understood that there will be no further supplements and as soon as it is economically feasible the entire work will be revised and reissued as a single volume.

The price of the Supplement at 80s is high, even for so useful a work as this and must lead to a limited sale in this country.

D.L.M.

2nd Edition of Hot Laboratory Equipment

HOT LABORATORY EQUIPMENT. Second Edit. Compiled by *L. G. Sang, Jr.*, for U.S. Atomic Energy Commission. 1958. Pp. 429. $2.50.

The Americans supplemented their contributions to the first Geneva Conference with a series of six books published by McGraw-Hill. One of these, 'Chemical Processing and Equipment', described the Idaho plant for processing irradiated reactor fuel elements and catalogued, with brief descriptions, 126 items of equipment for handling moderate to large amounts of radioactive materials. This volume is a revised edition of the equipment catalogue section and includes over 100 extra items. The first catalogue lacked an adequate index but this second lists each item described.

Order of presentation is largely unchanged. There are few additions to the details of enclosures for radioactive operations or viewing equipment. The principal additions to the range of manipulators are of accessories for the large manipulators and of the simpler tongs. Under chemical processing equipment several additional devices are listed including: a filtration unit and console, rare earth separation column, carbon 14 production equipment and radioactive-gas processing equipment. There is also an extended range of valves suitable for fluid transfer devices. More balances have been adapted for remote operation. Devices are described for remote density measurements, automatic recording titration, dry box pH assessment and for the determination of other properties of interest to the chemist and metallurgist.

The range of remotely operated machine tools grows and becomes more elaborate. There are considerable additions to the section on materials handling equipment but little addition to the monitoring and decontamination equipment or the description of irradiation facilities. A special one piece protective suit is described and this second edition ends with a brief article on shielding materials.

J. S. M. BOTTERILL.

Revised Organic Reagents Book A Practical Manual

THE B.D.H. BOOK OF ORGANIC REAGENTS. B.D.H. Laboratory Chemicals Division. 10th Edition. British Drug Houses Ltd., Poole, 1958. Pp. 175. 18s.

This completely revised edition of the well-known BDH book of organic reagents bears little resemblance to its predecessor which appeared 12 years ago. Contrary to usual practice, the subject matter has been considerably reduced in this new volume. Whereas the 9th edition contained monographs on the uses of 71 organic reagents, the number has now been reduced to 48, of which seven are included for the first time. Several reasons are given for this change. The present edition has as its principle aim the description of the quantitative uses of reagents which have proved satisfactory

and easy to use. The previous edition contained several reagents which, in the intervening period, have proved unsatisfactory or difficult to use, and others whose applications were confined to qualitative analysis only. Many of these are now dealt with in a separate publication dealing with spot test analysis.

The monographs in the new edition have been enlarged to include new and improved methods for the quantitative applications of the reagents, and the book takes on the more important aspect of a practical laboratory manual. Each monograph is fully descriptive and liberally supplied with references to the original literature.

Obviously, selecting a number of organic reagents for analytical purposes can lead to criticism. One may be disappointed to find that a particular reagent has not been recommended, although its uses are fairly widespread. But as this book makes no pretension to be an authoritative text book on organic reagents, such omissions are excusable. Its purpose is to provide details of workable methods of analysis for routine or occasional analyses using certain well-tried and tested reagents. It does this successfully and is to be recommended as a useful manual for general reference in the laboratory.

WILLIAM I. STEPHEN.

Introductory Textbook for Physics Students

ELECTRICAL AND MAGNETIC PROPERTIES OF SOLIDS. By *Dr. N. Cusack*. Longmans, London. 1958. Pp. 428. 45s.

Intended for degree physics students these electrical and magnetic properties of solids aims to be introductory for those beginning research. It is not very mathematical although some elementary vector analysis is used. There are 18 chapters on the basic physics of electric and magnetic phenomena of solids.

Electron gas model for metals, thermionic emission, photo-emission and thermo-electricity and conductivity are dealt with. These are followed by band theory and semi-conductor phenomena, magnetism—split into four chapters, superconductivity, dielectric effects and piezo- and ferro-electricity. There are an index and glossaries, as well as a short bibliography at the end of each chapter and 220 drawings.

An unusual feature is the titling of the introductory chapter as zero—but the preface is not figured as minus one. Each chapter begins with a pertinent paragraph or two from an article or book on the learned topic discussed. The overall view is that this is an excellent textbook which seems to be good value for money and one into which the postgraduate, happily past the book-learning stage, can dip to refresh his memory or can use it as a sort of reference book.

While it might be fair to say that the approach is academic or theoretical rather than practical or technological, the approach is quite up to date; for instance ferrites and titanates are discussed, although, surprisingly the latter is not in the index.

H. MANLEY.

Chemist's Bookshelf

NEW TECHNIQUES IN ANALYSIS

ANALYTICAL CHEMISTRY — SOME NEW TECHNIQUES. By *A. G. Jones*. Butterworths Scientific Publications, London, 1959. Pp. vi + 268. 40s.

Intended to meet the need of the non-specialist analytical chemist for a reasonable introduction to modern trends in analytical technology, this book is concerned with 8 selected topics. These are: flame photometry, differential spectrophotometry, differential refractometry, gas chromatography, coulometric titration, non-aqueous titrimetry, ion-exchange and methods for the determination of hydrogen and oxygen in metals. Several of these topics are not 'new' but in effect the author has summarised progress during the interval 1950-57.

Instrumentation and methodology rather than theory are considered by the author and this is probably a decision which will meet with general approval from the readers for which the book is designed. In the chapter on flame photometry he discusses general principles, factors which influence the performance of the instrument and the chemical system, flame spectrophotometry (for more complex systems), and modern trends such as the study of background radiation and the application of the technique to samples isolated by solvent extraction. The chapter ends by surveying the determination of Fe, Cu, Ca, Cr, Ga, In, Mg, Mn, Ag, Sr and non-metals, e.g. boron, halogens and phosphorus.

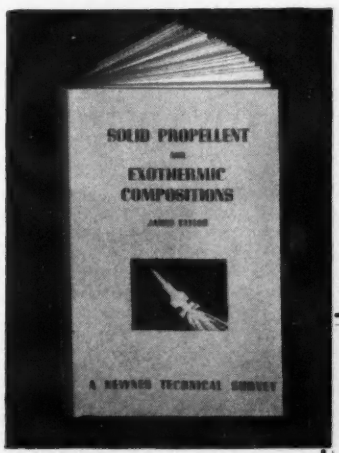
The section on differential spectrophotometry does in fact develop some of the basic theory. It is well written and particularly welcome in view of the slowness of analysts to avail themselves of this much more precise way of using the spectrophotometer. The other section on optical methods, i.e. differential refractometry, highlights a technique which is not as well known as one could wish and here again the reader's attention is focused on the most precise method of applying the principles of refractometry.

'Gas chromatography' is written with considerable enthusiasm and the exposition is certainly an excellent one. A very full discussion of detector devices places most emphasis quite appropriately on the thermal conductivity cell although one feels that, looking to the future, that the author might perhaps have pointed out some of the difficulties which may accrue from attempts to apply more sensitive detectors, such as the ionisation chamber or gauge, to ordinary analytical problems, e.g. difficulties due to impurities in reagents. The account given of ion-exchangers in analytical chemistry is most commendable and the section on non-aqueous titrimetry, although less detailed than the others, is also satisfactory.

In dealing with coulometric titration, the author does not appear to have stressed the increase in precision which is made possible since current and time can be measured so much more precisely than mass and volume. The final section on the determination of oxygen and hydrogen in metals gives pride of place to vacuum fusion methods, but renders a full account of less expensive chemical methods.

Undoubtedly this is a valuable book well suited to a wide range of analytical tastes and in my opinion it is a worthy successor to 'Recent Advances in Analytical Chemistry' published so successfully in the U.S. 10 years ago.

T. S. WEST.



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Latest Instalment of Houben-Weyl

METHODEN DER ORGANISCHEN CHEMIE (HOUBEN-WEYL). Vol. XI, Part 2, Stickstoffverbindungen II (continued) and III. 4th Edit. Edited by *E. Müller*. Georg Thieme Verlag, Stuttgart. 1958. Pp. xlviii + 844. DM.155 (subscription price DM. 139.50).

This book represents the latest instalment of the new, completely revised, fourth edition (begun in 1952) of the well-known 'Houben-Weyl', compiled by a group of leading German organic chemists, under the able editorship of Professor Eugen Müller.

The first part of the work (222 pages) is a continuation of the account of the chemistry of amines begun in Part 1 of the same volume. It deals with the chemical transformations of primary and secondary amines into imides, thioamides, amidines, carbonyl derivatives, nitramines and a host of minor derivatives (cross-references to earlier volumes are given in many places). A separate sub-section outlines the chemical reactions of tertiary amines (formation of *N*-oxides and their properties, quaternary ammonium salts). A useful section on the elimination of amine groups and their replacement by other groups completes the section.

Part III (pages 223 to 751) has five main sections. The first deals with ethyleneimines and trimethyleneimines, including their preparation, chemical reactions, analysis, toxicology and pharmacology. Then follows a lengthy section on α-amino-acids and their derivatives (occurrence, stereochemistry, physico-chemical properties, isolation, methods of synthesis, reactions and analysis), with a special section devoted to the detailed chemistry of the individual amino-acids. There is also a section on amino-acids other than α-amino-acids, and a useful bibliography. The third section covers β- and higher-membered lactams (preparation and reactions), and the fourth quaternary ammonium compounds. The last deals with nitrogenous sulphur compounds (sulphamic acids, *N*-sulphinic acids and *N*-sulphenic acids and their derivatives).

Layout is the same as in the earlier volumes, and will be familiar to organic chemists, who will welcome this latest addition to the series. The great value of the work as a whole is as a time-saving reference source for a host of organic preparations and transformations. Full preparative details of particular examples of each reaction described are provided, with the appropriate literature references. There are countless numbers of the latter, from a thousand of the world's chemical journals, and the editor and authors have made strenuous efforts to cover the more recent literature (in one chapter references up to June 1958, are included). Extensive use of tables has enabled more material to be included; the tables (there are 84) are of an unusually comprehensive type, giving, in many cases, the name and structural formula of the compound concerned, the reaction conditions, the reaction product (name and structural formula), the yield, and references. There are also eight figures, and comprehensive author and subject indexes; a formula index would have been a useful addition.

The editor and authors are to be congratulated warmly on this latest member of a most valuable series. The formulae and figures have been executed beautifully; skilful arrangement of the former in the text has eliminated the use of large Roman numerals for labelling. An astonishing amount of material is presented in a readable style, making it easy for the reader to find what he is seeking. The book is printed on high-quality glossy paper, with remarkably few errors, and is bound in an attractive blue moleskin, with a pleasing silk bookmark.

Price is reasonable, though the work will be purchased mainly by chemical libraries, which cannot be regarded as complete without it.

A. R. PINDER.

ZOLLINGER'S CHEMISTRY OF DYES

CHEMIE DER AZOFARBSTOFFE. By *H. Zollinger*. Birkhäuser Verlag, Basel. 1958. Pp. 308 with 19 figures and 9 coloured plate. Sw. Fr. 36.25.

In common with most other branches of chemistry the chemistry of dyes has grown so rapidly during the last 20 or 30 years that modern textbooks on the subject bear little resemblance to those in use before the war. So big indeed has the subject become that publications which cover the whole of the field have become necessarily both expensive and selective. There is in fact an important need for monographs which deal in an authoritative way with restricted branches of the subject. Dr. Zollinger's monograph is a worthy example of what is required, written as it is by one who has worked for many years with azo dyes and made important contributions to their chemistry. The book as a whole has a scientific rather than a technical outlook, though practical questions are discussed in almost every chapter. Its strong points are the emphasis which it places on modern physico-chemical studies and the range of general chemical experience on which it draws.

Methods of diazotisation and its mechanism are reviewed at the beginning of the monograph. Then follows a discussion of the nature of diazonium ions, the relationship of these to diazo compounds, and the isomerism of these. The reactions of diazonium salts are then considered. After a review of the chemistry of diazoamino compounds the author proceeds to a discussion of the preparation of azo-compounds and the mechanism of the coupling reaction. The application of the principles which emerge to the technical preparation of azo-compounds and a brief review of technical azo compounds of all types are included. There are finally chapters on the relationships between the properties and chemical constitution of azo dyes, their complexes with metals, and their application in dyeing and printing. There are useful author and subject indexes.

The volume as a whole makes an impressive addition to the literature of chemistry. The treatment throughout is modern and most chemists will derive both pleasure and advantage by reading its pages. The wealth of references alone to modern work on chemical principles and the chemistry of azo compounds makes the monograph a volume that everyone will be glad to have at hand.

The book is admirably printed and the clear diagrams add much to its appeal.

W. BRADLEY.

Ready Reference to Chemical Toxicology

POISONING BY DRUGS AND CHEMICALS: An Index of Toxic Effects and their Treatment. By *Peter Cooper*. Alchemist Publications, 25 Oxford Street, London. 1958. Pp. 209 + x. 25s.

To provide doctors, pharmacists, chemists, etc., with a ready-reference guide, neither too detailed nor too elaborate, to the toxicology of the commonly handled drugs and chemicals. Peter Cooper has compiled this index from an extensive collection of reports of actual poisoning cases. He has also included facts previously only to be found dispersed through a number of not very widely available reference books.

Some 350 alphabetically-arranged monographs on individual substances form the main part of the book, from 'acetazolamide' to 'zinc.' Each monograph gives the alternative (including proprietary) names of the compound, followed by notes on its action, its absorption and excretion in the body, its toxic effects, possible effects of massive overdose, suggestions for treating cases of poisoning with the compound, and simple aids of identification. The more important first-aid measures for use in cases of poisoning, e.g., artificial respiration, gastric lavage, the use of emetics and "universal antidotes," etc., are discussed in an appendix.

Included in the 15-page index are generic names, proprietary names, chemical names and synonyms, which permits immediate reference to the appropriate monograph. The compact format of the book (no bulkier than the British *National Formulary*) allows it to be carried in the pocket or in the doctor's bag, while the distinctive yellow binding should enable it to be picked out quickly when needed in an emergency.

This reference work is undoubtedly a must for all medical departments of industrial medical departments. L.D.

RECENT ADVANCES IN STEREOCHEMISTRY

STERIC EFFECTS IN CONJUGATED SYSTEMS. Edited by *G. W. Gray*. Butterworths Scientific Publications, London, Academic Press Inc., New York, 1958. Pp. 181 + viii. 30s.

The proceedings of the Chemical Society Symposium on 'Steric Effects in Conjugated Systems' held at the University, Hull, during 15-19 July, 1958, have now been published. Of the 15 papers presented at the symposium, the majority (11) were concerned with the effect of non-coplanarity in conjugated systems on the transition energy and probability of excited states, both those due to the absorption of radiation and those due to thermal activition in the course of chemical change. The four contributions dealing with ground state phenomena were the introductory paper on the elucidation of the structure of diphenyl and its optically active derivatives (Professor E. E. Turner), a study of steric effects in aromatic molecules by means of dipole moment measures (Dr. J. W. Smith), and accounts of the mesomorphism (Dr. G. W. Gray) and of the vapour-phase chromatography (Dr. E. A. Johnson) of substituted diphenyls.

Detailed accounts of experimental work on the electronic spectra of substituted diphenyls (Dr. G. H. Beaven), di- and tri-phenylmethane dyes (Dr. C. C. Barker), conjugated carbonyl compounds (Professor W. F. Forbes and Dr. E. S. Waight), and substituted anilines (Dr. B. M. Wepster), make it apparent that while steric deformation of a conjugated system invariably lowers the intensity of the first absorption band, the position of the band may be shifted either to the red or to the blue. This result was explained in two papers (Professors C. A. Coulson and M. J. S. Dewar) on the molecular orbital theory of deformed conjugated systems. The resonance across a π-bond is lowered when the bond is twisted, and an electronic absorption band shifts to the red or to the blue as the π-bond order decreases or increases, respectively, on electronic excitation.

In the field of reaction kinetics steric effects are more complex, for a substituent may hinder or facilitate the approach of an attacking reagent as well as inhibit conjugation in the substrate. These effects were carefully distinguished in a review of nucleophilic aromatic substitution (Professor N. B. Chapman). In further papers the Hammett treatment was extended to the solvolytic reactions of substituted arylmethyl chlorides (Professor H. C. Brown), and to the influence of *ortho* groups on the reactions of benzene derivatives generally (Mr. A. C. Farthing). Finally, steric and conjugation effects on the rates of hydrogen-deuterium exchange and on the ionisation constants of the mono-methyl-1,2-benzanthracenes were shown to closely correspond (Dr. G. Dallinga), implying that the transition state for the exchange has a structure akin to that of the cation.

In general, this book gives a concise account of recent advances in the field of its title, and there is little overlap with other recent publications on stereochemical subjects.

S. F. MASON.

Chemist's Bookshelf

I.C.I.'s Avon Project

THE proposed new Imperial Chemical Industries' plant at Hallen, near Bristol, will employ between 5,000 and 6,000 when completed, and an investment of £25,000 to £30,000 per man employed was expected, which is eight to 10 times the average for all industry. This information was given by Dr. H. S. Hirst, general manager of I.C.I. Severnside, at a Gloucester meeting of farmers' organisations, etc.

According to Dr. Hirst, a small team of experts has been engaged on general planning and exploratory work for the past year. It has not yet been announced what products will be produced at the Avon site.

INTERSCIENCE PUBLISHERS -- New York -- London

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VOLUME 1, NUMBER 1, FEBRUARY 1959

This new international quarterly is devoted to reporting the practice and theory of processes and investigations in which biochemical and microbiological phenomena are directed towards a technological end. The major subject areas are to be covered from the laboratory to the industrial level and include: isolation of chemical products from natural sources, industrial fermentation, industrial enzymology, biological waste treatment, brewing and wine-making, food-processing, and all the pertinent "unit operations" (e.g. sterilization, freeze drying, ion exchange, multi-enzyme reactions, etc.).

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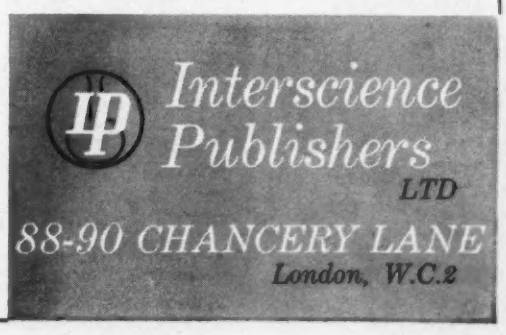


FUTURE PLANTS WILL RELY MORE ON MATHEMATICAL-ANALYTICAL CONTENT

IN his address to the North-western branch, Institution of Chemical Engineers, entitled 'A chemical engineer looks at systems engineering' (CHEMICAL AGE, 7 February, p. 242) Professor E. S. Sellers said he preferred the American term 'systems engineering' to 'control engineering'.

He felt that the term 'control engineering' placed too much emphasis on the control of a process, whereas the main issue must always be one of design for a system as a whole.

'Systems engineering' was defined as "that engineering procedure which leads to balance and co-ordinated assemblies of components for economical automatically controlled systems".

Professor Sellers considered the basis on which chemical engineers established design criteria. Research on a process specified temperatures, pressures and concentrations which must be maintained to produce the required quality of product, he said, and it was almost always assumed that the plant was to be operated under steady state values. The information was combined with other variables by the engineers who designed the plant.

At a certain stage, usually near the end of the procedure, control instruments were added to maintain the steady state conditions; that was a difficult problem with complex processes because, in general, control instruments only controlled one variable at a time, therefore storage capacity was provided between the units of plant, and large equipment, slow to respond to changes, was preferred.

The new approach substituted small, responsive equipment with control systems for mass and storage capacity to obtain maximum advantage from investments in men, money and materials, whereas the concept of a steady state design attempted to suppress the dynamic effects in a process. An increased rate of production was obtained by improved operating decisions, by better control of the process and by better understanding of the dynamics of the process. These principles were illustrated by a simplified example of a plant for a polymerisation process; any possible restrictions were considered in the design, a digital computer was required to do the calculations and could be coupled direct to the controls to enable the plant to operate all the time for maximum profit.

Computer control differed from automatic control, Professor Sellers said, and illustrated it by the effect of a sudden change in composition of a feed to a plant. The automatic control did the maximum possible regulation by the self-regulation unit built into it; an amount of product of undesirable quality was produced because the feed-back system could only apply a correction when a change from a set point had occurred. The longer the time lag the greater the amount of product of dubious quality. Higher control gains and faster re-sets minimised the effect of the upset at the expense of greater instability.

As the computer control knew how a process reacted to an upset, it made calculations as soon as the upset was detected at the inlet to the plant, it adjusted the controls in a manner similar to the adjustment made more slowly by the feed-back controller, but the calculation and the alteration were done so rapidly that the upset at the inlet had no effect on the quality of the product at the outlet.

It seemed obvious that the design and the operation of future plants and processes would have a greater mathematical-analytical content than former ones.

New Records for British Plastics

EXPORTS of plastics raw materials from the U.K. in 1958, over 122,600 tons valued at over £32 million, set up new records both by volume and by value, it is announced by the British Plastics Federation. The totals were advances of more than 10,000 tons and more than £2¼ million on those for 1957, when the previous highest levels were reached.

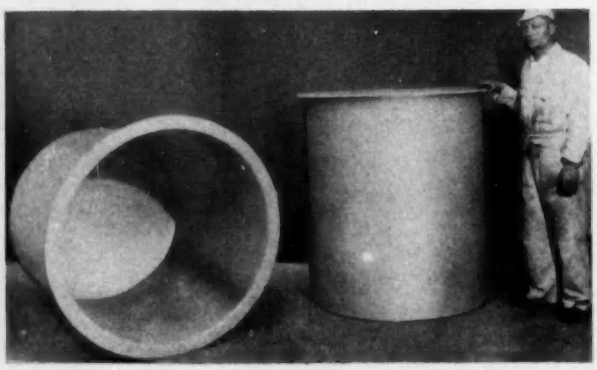
The volume of exports has been more than doubled in five years (1953 total, 56,000 tons), and is more than five times the tonnage for 1947 (21,000 tons).

The biggest buyer in 1958, as for several years past, was Australia (nearly £4.5 m. compared with £4 m. in 1957) and exports to New Zealand rose to over £2.4 m. (1957, £1.6 m.). France, just under £2 m., Sweden, £1.6 m., South Africa, nearly £1.5 m., and the Netherlands, over £1.5 m., were other large markets, and exports to Western Germany, over £1.3 m., were nearly double their 1957 level (£700,000). Sales to Denmark, Italy, Belgium and Norway were all over £1 m. and both to Hong Kong and India, over £900,000.

The raw materials include moulding powders, resins, sheet, rod, tube, film and foil, but not exports of finished products (domestic ware, toys, clothing, etc.) and of parts incorporated in other finished articles (in aircraft, motor, electrical and radio, and similar products).

Exports of plastics processing machinery are also rising. A forthcoming export drive of the industry, just announced, is the composite display by the British Plastics Federation in collaboration with the Board of Trade, at the International Plastics Fair, Dusseldorf, 17 to 25 October.

Metal Containers' Large Polythene Vats



Moulded polythene vats of 250 gall. capacity made by Metal Containers Ltd. and believed to be two of the largest produced in Europe. (See 'Chemical Age,' 7 Feb. 1959, p. 251)

Widnes Phosphorus Plant Closing Down

Albright and Wilson (Manufacturing) Ltd., have decided to discontinue the manufacture of phosphorus at Widnes and to concentrate production at their Portishead and Oldbury furnaces. The Widnes plant has been working continuously for 25 years.

The firm state: "Technical advances which have been made during this time, both in the manufacture of phosphorus and in certain phosphates, have now rendered the plant obsolete. As the total demand for phosphorus can only be met by the Portishead and Oldbury plants both operating, there was no alternative to closing at Widnes."

Anti-Scuffing Lubricant

Rocol Ltd., Swillington, nr. Leeds, have introduced a new aerosol packed anti-scuffing spray for the application of molybdenum disulphide lubricant films to metal or plastics surfaces. The spray contains a basis of molybdenum disulphide of particle size for surface treatments, and bonding resin to effect retention of a film, plus a propellant.

Overseas News

LARGE-SCALE EXPANSION PLANNED FOR EAST GERMAN VEB LEUNA-WERK

DETAILS have been issued from Eastern Germany of the large-scale expansion to take place between now and 1965 at one of the country's main chemical plants, the VEB Leuna-Werk Walter Ulbricht. The expansion is part of the long-term national plan for expansion of the chemical industry.

Main points of the expansion programme are to be the hydrogenation installations and the organic department of the plant. Production of ammonia, urea and other inorganic products is also to be raised considerably.

The hydrogenation installation is to be operated under medium-pressure processes and not under high-pressure processes (250 atmospheres) as before. This will mean a large saving in hydrogen.

Combined production of the plant, which is to begin operation in close conjunction with the neighbouring Lützkendorf mineral oil plant, will have been raised by an estimated 90% by 1965. This will be achieved by the erection of more modern and larger production units with higher capacities, a higher degree of automation and a greater standard of efficiency. Discontinuous processes will be turned into continuous ones. New forms of catalytic processes (including 'fluid-system' catalysing) are among the improvements planned.

Italian Exports of Fertilisers in First Half 1958

During the first eight months of 1958, Italy exported 525,200 tons of chemical fertilisers to a total value of Lire 15,066 million. This is an increase of 21.8% in quantity and 10.8% in value, as compared with the totals recorded in the period January to August 1957 (431,000 tons for Lire 13,600 million).

In the same period, Italian imports of chemical fertilisers rose from 94,248 tons to 127,135 tons in quantity (34.2% increase) and from Lire 2,549 million to Lire 3,527 million in value.

U.S. Glycerol Position

There are suggestions that additions to present U.S. facilities for synthetic glycerol may be required. Last year there was an 11% drop in production and a loss of 11.5% in stocks. Output of crude glycerol (including that synthesised from propylene) was 213 million lb. compared with 239.1 million lb. in 1957. The fall in production is due to cutting back in soap production and restricted sales by fatty acid producers.

The U.S. Glycerine Producers Association reports that U.S. glycerol imports in 1957 exceeded exports by 17 million lb. but in 1958 may have been as much as 1 million lb. less. This is due to Argentina and European countries who have previously made up U.S. deficits having found other markets at home and abroad.

Glycerol producers in the U.S. are basing plans on expectation of technical advances in the alkyl field which at present is taking 30% of the annual glycerol supply. Other glycerol-consuming uses of importance are in cellophane processing and in production of monoglyceride, diglyceride and related food additives.

Dutch Participation in Spanish Company

A 50% participation in the Spanish firm Resinas Artificiales Viladecans S.A. by the Dutch company N.V. Chemische Industrie has been approved by the Spanish Government. The Dutch company will provide patents and technical knowledge as well as capital.

Proposed Phosphate Fertiliser Plant for Chile

Corporacion de Fomento and their subsidiary, the Sociedad Chilena de Fertilizantes, are studying a proposal for establishing a phosphate fertiliser plant in the Maule area of Chile. A technician from CORFO is reported to be in Western Germany carrying out technical studies connected with the proposal.

German Company Increases Polythene Production

New sections are being put into operation at the plant for manufacturing polythene (Lupolen) by the high-pressure process in the Rheinische Olefinwerke, in which Deutsche Shell and B.A.S.F. each have a 50% interest. The first plant for the production of a hard type Lupolen by the Phillips low-pressure method is nearing completion.

B.S.A.F. have decided to build a plant for the production of dithiocarbamates and thiurams to meet home and overseas demands for fungicides.

Photo-electric Determination of Humidity of Gases

A new invention of the Société Anonyme des Manufactures des Glaces et Produits Chimiques de Saint-Gobain allows the photo-electric determination of the humidity of gases. The process involved consists of the gas in question being brought into contact with fuming sulphuric acid and the transparency of the resultant 'mist' being measured. A container of fuming sulphuric acid is attached above a packed column. The acid drops onto the column's contents and through them to meet the humid gas and set up the mist referred to above. This mist is led through a second, similar-filled column to remove the over-large vapour particles and then directed along an analysis tube for measurement. An air de-humidifying apparatus, which completes the invention, consists of a gas-washing bottle filled with sulphuric acid as well as two filled columns one of phosphoric anhydride and the other of silica gel.

Courtaulds Propose Viscose Spinning Plant in Natal

If suitable tariff protection can be given, Courtaulds will build a £3 million viscose spinning plant at Umkomaas on the Natal coast. Sir John Hanbury-Williams, chairman, said in Durban that the plant would be run in conjunction with the existing rayon pulp plant at Umkomaas operated by South African Industrial Cellulose Corporation, a Courtauld subsidiary.

Austrian Nitrogen Works Increase Output

Austria's leading chemical group, the Austrian Nitrogen Works, Linz, increased their turnover last year to Sch.1,200 m., or 3% more than in 1957. Production was higher by 80,000 tons at 980,000 tons. During last year the manufacture of granulated fertiliser and urea was started.

Polytrifluorchlorethylene as Anti-corrosion Shield

Poly-trifluorchlorethylene is being produced in aerosol form as a thermoplastic corrosion shield by the Polyfluoron Acme Resin Co., U.S. The film, applied at 235°C, is chemical-resistant, water- and temperature-resistant and of great hardness. With the use of a primer, three coats are needed; without a primer four or five are recommended. Each coat is treated with cold water after application. The film's thickness is between 3 and 5 mm. Suggested uses are with piping, containers, etc., on exposed surfaces.

Australian Petrochemical Site

Following the announcement that four Australian and overseas companies are participating in the setting up of four petrochemical plants (see Overseas News last week, p. 247), C.S.R. Chemicals Pty. and Dow Chemical Co., U.S., have taken an option on a 500-acre site in the Melbourne industrial suburb of Altona in connection with the £A23 million (£18.4 million) petrochemical project.

Degussa's Atomic Metals Interest

Degussa (Deutsche Gold- und Silberscheideaustalt) AG. have announced that the main part of the pure uranium which they have started producing at their Wolfgang plant will be used in the manufacture of fuel elements for the new atomic reactor now being built under

the auspices of the West German Government at Carlsruhe. The reactor is to be used for research purposes.

The company have now also begun production of pure thorium and hafnium-free zirconium. All apparatus used in the production of all these radioactive materials has been developed by the company itself, which has exported similar plant and plant for the manufacture of atomic reactor elements to Spain, India, the Argentine, Italy and Sweden. Up to DM2 million (about £167,000) has been spent by the company on staff safety equipment and installations.

French-German Consortium to Build Greek Fertiliser Plant

A French-West German consortium, consisting of the French firm Ammonie Casale and the Dortmund concern Friedrich Uhde G.m.b.H.—a subsidiary of Knapsack Grieshelm AG.—has been given an order by the Greek Government for the erection of a nitro-fertiliser plant at Ptolemais. Cost of the plant will be about £13 million.

Growth of Dutch Plastics Industry

Speaking at the opening of the main office of the Dutch plastics marketing concern Verenigd Plastic-Verkoopkantoor (see CHEMICAL AGE, 24 January, p. 182), Mr. M. J. van der Hoeven, a director of the new company, said that the plastics industry's rise to the top in Holland could best be shown by the following comparative statistics: in 1938 some 2,085 tonnes of plastics were imported at a value of 1,200,000 florins (about £120,000), as against 41,500 tonnes in 1957 at 115,600,000 florins (about £11,560,000). In the same two years exports from Holland amounted to, respectively, 549 tonnes worth about 350,000 florins (about £35,000) and 27,160 tonnes at 71,700,000 florins (about £7,170,000). Imports of polythene into Holland rose from 288 tonnes in 1952 to 5,144 tonnes last year, although plastics material is made in Holland.

Borregaard Buys Mining Concern

The Norwegian company Borregaard, has taken over the mining establishment Foldal Verk A/S, which has for many years delivered pyrites to Borregaard. Last year it mined 82,000 tons of crude ore, from which it produced 40,000 tons of pyrites, 3,000 tons of zinc, 3,300 tons of copper concentrate, 27 lb. of gold and 1,500 lb. of silver.

Dow Markets Vinylidene Chloride Copolymer Fibre

New monofilament yarn marketed by Dow Chemical Co., U.S., under the trade name Rovana is a vinylidene chloride copolymer. The filament is described as a flat film tape with a 'unique' folded cross section, which imparts good coverage ability and tear strength to the fibre. Embossing is also reported to be easy.

The fibre is produced in 300, 400 and 550 deniers and 10 colours at present. It is expected that it will compete with other strong filaments in household and industrial uses.

Synthetic Fibre Production in East Germany

The Premnitz, East Germany, plant of the state-owned Chemiefaserwerk Friedrich Engels will be turning out 10,000 tonnes of the new synthetic fibre Prelana by 1965, it is announced from East Berlin. At present Prelana is being produced in an experimental installation at Premnitz. A special plant, financed by Russian credit, will come into full production on 1 April, 1961.

US and German Firms form Joint Catalyst Company

Chemotron Corporation, of Chicago, and the Munich company Süd-Chemie AG., have set up a joint subsidiary company for the production and marketing of catalysts. The name of the company is Girdler-Südchemie-Katalysator G.m.b.H., Munich. Of the initial capital of DM 250,000 (about £20,000) each company holds 50%. The company is to work closely in contact with the Chemotron subsidiary company, Girdler Catalysts, of Louisville, Kentucky, and its first job will be the marketing of Girdler Catalysts' complete range of catalysts in Europe, as well as marketing and service work—particularly connected with the oil industry—in the Middle East and in Africa.

Another Chemotron subsidiary, Girdler Construction Division, of Louisville, recently drew up a co-ordination agreement for chemical processes with the Cologne firm of J. Meissner.

Firestone to Build Synthetic Rubber Facilities in Texas

Plant to produce polyisoprene and polybutadiene rubbers is to be built by Firestone Synthetic Rubber and Latex Co., Akron, Ohio. It will be located at the company's Orange, Texas, petrochemical facility, where butadiene is available and it will have a capacity of 30,000 tons a year of either product.

A construction schedule has not yet been drawn up. Preliminary engineering work is stated to be finished, and production is expected within two years.

Polybutadiene, known as Diene, is a natural rubber extender. Polyisoprene, or Coral rubber, is intended to be a complete substitute for natural rubber. Both products are still experimental.

Australian Mineral Industry in 1958

OUTPUT of Australia's mineral industry as a whole continued at a high level. Rutile and zircon, it is noted, show a fall from the previous record levels of the last year or so, but the total will still be above the 1955 level. The total value of Australian mineral production in 1958 is expected to be below the £A211.6 million registered in 1957, and a total of the order of £A205 million is considered probable.

Mineral exports, which in 1957 were £A69.6 million (excluding gold) are expected to fall below £A60 million, because of lower prices and reduced shipments of lead, zinc, rutile and tungsten.

Mineral imports will show a decided increase for 1958 (£A78.1 million in 1957 excluding gold). Mineral commodities which in 1957 were valued at £A14.8 million will probably be about £17 million, arising from increased imports of rock phosphate, sulphur and asbestos.

Beach sands. Production of rutile has fallen to about 80,000 tons (128,952 tons in 1957) and zircon to about 55,000 tons (88,561 tons). A large amount of capacity remains unused and present contracts for rutile are said to be being met almost entirely from existing contracts. Cash sale prices for rutile are put at £A30 a ton.

Demand for zircon is stated to have been fairly well maintained for the tonnage available. Prices have shown a tendency to firm: from £A8 to £A10 a ton early in the year they have improved to £A10 to £A12.

Ilmenite production capacity in Western Australia is about 300,000 tons. Shipments for the year, however, are not expected to total more than 80,000 tons. Recent prices are reported to have ranged from £4 to £5 f.o.b. Bunbury.

Uranium. The treatment plant at Mary Kathleen has commenced operations and the first uranium concentrate shipment has been received at Springfields (CHEMICAL AGE, last week's issue, p. 199). Northern Hercules gold treatment plant has been modified to treat uranium ore.

Statistics of production of U_3O_8 have not as yet been fully released, but Australian production at present is estimated at the rate of about 1,000 tons a year.

Sulphur. Production of sulphuric acid exceeded 1 million tons for the first time, it is reported. The Mary Kathleen acid plant commenced operations during the year and, as this large plant is based on elemental sulphur, there has been some reversion of the tendency in recent years for an increasing proportion of acid to be produced from indigenous materials. The proportion is reported as having fallen below 50%. Imports of elemental sulphur increased and are expected to total about 200,000 tons.

Other new plants completed during last year included that of Australian Fertilisers at Geelong, Victoria (to operate on refinery gas or on sulphur) and a third contact unit at Risdon.

Pool price of imported sulphur, it is stated, has been reduced further to £A17 10s. a ton, due in part to lower freight rates.

The Tariff Board has been considering the further extension of the Sulphuric Acid Bounty Act, and appropriate rates and conditions of bounty (*Chemi. Engng. and Mining Rev.*, 1958, **51**, No. 3, 42).

PEOPLE in the news

● DR. J. C. TATLOW, Ph.D., D.Sc., at present Reader in Organic Chemistry in the University of Birmingham, has been appointed to the newly established Chair of Organic Chemistry within the Department of Chemistry from 1 March.

● MR. E. W. GREENSMITH (I.C.I. central engineering department) presided at the 41st annual dinner of the Chemical Engineering Group, Society of Chemical Industry, in the Cafe Royal, London, on 6 February, in the absence through ill-health of chairman MR. R. F. STEWART (director, Dorr-Oliver). MR. H. W. FENDER (Prodorite Ltd.), chairman, British Chemical Plant Manufacturers' Association, proposed the toast of 'The Society.' Proposing the toast of 'The Guests,' Mr. Greensmith particularly welcomed Sir Robert Robinson, the first president of the S.C.I. to attend the group's dinner. DR. ARTHUR MARSDEN who responded for the guests, has been connected with the Western Group since 1921.

● MR. JOHN MACFARLAN, S.A.I. manager at Ayr since 1954, has been appointed chief agricultural adviser by Scottish Agricultural Industries Ltd., at Edinburgh. He will succeed Mr. David E. Simpson who will continue in an advisory capacity. Mr. Macfarlan graduated in pure and agricultural chemistry at Glasgow University in 1933 and worked for three years on research at Auchencruive. He was then lecturer at the West of Scotland College and joined S.A.I. in 1946 as a technical officer based on Glasgow. MR. JOHN P. JOHNSON succeeds him as S.A.I. manager at Ayr. He is a graduate of Glasgow University and joined S.A.I. in 1952. He has been technical officer for East Lothian.

● Newport Education Committee has co-opted DR. N. DYSON, general works manager of Monsanto Chemicals Ltd., as a governor of the Newport and Monmouthshire College of Technology.

● MR. S. DIXON, M.Sc., F.R.I.C., who has been elected chairman of the Western section of the Society for Analytical Chemistry, is public analyst for Cardiff and Swansea. A native of Gainsborough, Lincs, he was chief assistant to the Derbyshire county analyst before going to Cardiff in 1929.

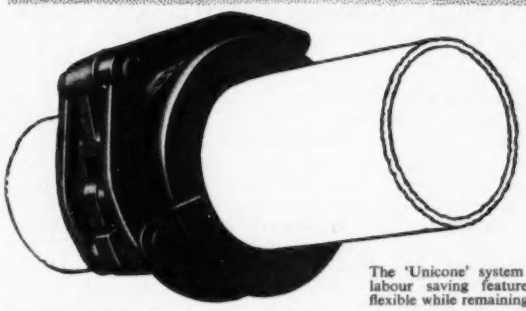
● MR. M. HAMSHAW has been appointed managing director of Chemical Engineering Wiltons Ltd. (a subsidiary of Simon-Carves Ltd.).

● Cyanamid of Great Britain Ltd. announce the following promotions and appointments to the staff of their general chemicals division: MR. R. I. H. BAKER, M.A., promoted to sales supervisor, MR. A. R. BROWN, promoted to technical service supervisor, MR. P. F. TAYLOR, B.Sc., joining the company as a technical representative in the Midlands area, MR. J. E. SALMON, B.Eng.(Chem.), joining as a technical representative dealing mainly with paint and allied industries.

● At the annual meeting of the British Supporting Group for the World Medical Association held recently at B.M.A. House, DR. T. H. MANNERS KERFOOT, was elected president for 1959 in succession to DR. ALEXANDER HALL, a former B.M.A. president. Dr. Kerfoot is also president of the Association of British Pharmaceutical Industry.

● MR. C. BENSON BRANCH, manager of the Dow Chemical Company plastics department since 1952, has been named manager of all Dow overseas activities except those in Canada and Mexico. He has also been elected president of Dow Chemical International Ltd. S.A., a recently-formed and wholly-owned Dow subsidiary.

INSTANTANEOUS! JOINTS



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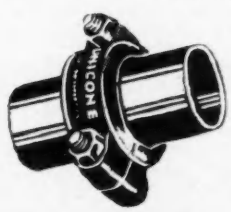

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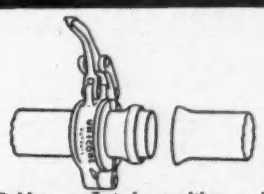
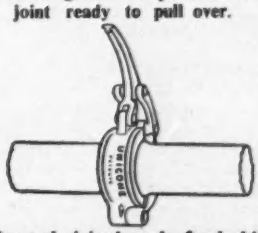
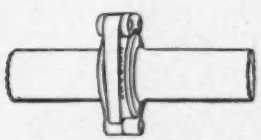


Rubber gasket in position and joint ready to pull over.



Pipe ends joined ready for locking.



The completed joint.

V G

Commercial News

- **Universal Asbestos Profit Increases**
- **International Nickel Repeat Dividend**
- **Shawinigan Take Over Canadian Resins**
- **Chemstrand Earnings Reach New High Level**

Universal Asbestos

Dividend of the Universal Asbestos Manufacturing Co. is being raised from 10½d to 1s per 5s share with a final of 7½d per share for the year to 28 September 1958.

Group profit, after all charges, including depreciation, increased from £201,358 to £335,237. Net profit is up from £84,309 to £151,933.

International Nickel

The International Nickel Company of Canada is repeating its quarterly dividend of 65 cents a share payable March 20. Dividends for 1958 totalled $2.60 a share compared with $3.75 for each of the three preceding years when year-end extra payments of $1.15 were paid.

Shawinigan Chemicals

Shawinigan Chemicals are to become the sole owners of Canadian Resins and Chemicals through the acquisition of Union Carbide of Canada's 51% interest in Canadian Resins. Shawinigan Chemicals already own the remaining 49% interest in Canadian Resins.

Subject to approval from the Quebec Electricity Board, Shawinigan Water and Power Co., the parent company of Shawinigan Chemicals, propose to issue not more than 125,000 additional common shares to Union Carbide to effect the purchase. Upon acquisition Shawinigan Water and Power will transfer the interest to Shawinigan Chemicals in exchange for additional chemical common stock.

Hilger and Watts Ltd.

Hilger and Watts Ltd. in association with Englis Equipment, of Chicago, are forming an affiliated U.S. company to be called Hilger and Watts Inc.

Chemstrand Corp.

Earnings of Chemstrand Corporation reached a new high level in the last half of 1958, it is reported, making a full year showing only a little below that of 1957.

Consolidated net income in 1958 after all charges and taxes, amounted to $18.35 million, compared with $18.81 million. Net income of Chemstrand, U.S., was $19.19 million ($20.05 million). Consolidated sales of Acrilan acrylic fibre and Chemstrand nylon amounted to $172.97 million ($145.44 million). Sales by Chemstrand, U.S., were $170.63 million compared with $146.04 million. During the final quarter of 1958 Chemstrand paid a dividend of $5 million to two shareowners, American Viscose and Monsanto Chemical. The corporation also repaid $5 million of its $25 million term loan, negotiated in 1957 and $5 million of its 4% subordinated notes held by the two parent companies.

B.A.S.F.

Turnover of Badische Anilin- und Soda-Fabrik AG during 1958 was DM 1,930 million (about £161 million), an increase of 7.2% on 1957. The dividend will be declared on 6 April.

Despite the satisfactory results, trading was carried out under heavy price pressure and export trade became much more difficult. While home turnover rose by 8.2%, revenue from abroad increased by only 5.4%. Not only synthetic fertiliser sales, but also those of chemical products produced in large quantities were influenced by the setting up of manufacturing plants for these commodities in under-developed countries.

Price pressure accounted for a considerable difference between rise in production and rise in turnover. With the turnover increase of 7.2%, there had been an increase in production of between 9 and 10%. Research expenditure took up about DM 100 million (about £8,340,000), or some 5% of the total turnover.

Synthetic fertilisers and pest-control chemicals accounted for between 20% and 22% of turnover and dyes and other textile chemicals between 18% and 20%. The largest share, 40%, was, however, taken up by plastics and raw materials for synthetic fibres. With steadily sinking prices, world plastics production reached an estimated 1958 capacity of 4.1 million tonnes, of which about 2.5 million tonnes came from the United States and some 0.6 million tonnes from West Germany, which had increased production by 15% over the previous year; world plastics prices were estimated to have fallen in the past eight years by 50%.

During the current year the stress of B.A.S.F.'s investments—again set at DM 250 million—is to fall on the development of plastics. Considerable sums will be laid out on research in 1959 as foreign competition forces the company to develop new products.

NEW COMPANIES

DUNDAS CHEMICAL COMPANY (MOSSPARK) LTD. Capital £40,000. Directors: D. Dundas, F. D. Dundas and G. M. Dundas. Reg. office: Mosspark, Dumfries.

SARO-NUCLEAR ENTERPRISES LTD. Capital £10,000. The company will carry on research and production in nuclear science, and deal in necessary equipment, instruments, goods, chemicals and materials. The first directors will be three nominated by Saunders-Roe Ltd. and two by Nuclear Enterprises (G.B.) Ltd. Reg. office: Osborne, East Cowes, I.W.

Market Reports

STEADY DEMAND IN MOST SECTORS

LONDON There has been a steady call for supplies in most sections of the industrial chemicals market with home demand maintained at about the recent level, and a fair movement in exports.

Hydrogen peroxide is in good demand, and dichromate and chlorate of soda are in active request among the soda products, and there is a ready outlet for the potash chemicals. Business in fertilisers is a little more active and the next few weeks should bring an expansion in interest in this market. Quotations generally are steady.

The Distillers Company announce lower prices for dimethyl phthalate, diethyl phthalate, di-isobutyl phthalate and dibutyl phthalate. The change operates from 1 February, and the new 10-ton price for dimethyl phthalate is £175.

Demand both on home and export account remains reasonably good for pitch, creosote oil and cresylic acid.

MANCHESTER The past week has seen a moderate flow of fresh inquiries on the Manchester market for heavy chemical products. So far as deliveries under contracts are concerned, there is plenty of room for improvement in the takings of the cotton textile and allied trades, but the demand from other industrial consumers is on a fairly satisfactory scale. Quotations generally are on a steady basis. The movement of fertiliser materials is gradually picking up, and a quietly steady demand is reported for most of the tar products.

GLASGOW Business on the Scottish heavy chemical market opened reasonably active and continued throughout the week on the same basis. Quite a volume of varied inquiries were received and demands both against spot and contract were well maintained, particularly in regard to the general range of basic chemicals. The trend of prices showed little variation and mostly remained firm and the overseas market is still showing interest. The position of agricultural chemicals remains unchanged.

TRADE NOTES

Remote Viewing Medium

F. W. Berk and Co. Ltd., Berk House, Portman Square, London W.1, have produced a booklet on optical and shielding grades of zinc bromide solution for use in remote viewing and biological shielding against gamma rays and X-rays. Zinc bromide optical grade is a 77% solution of zinc bromide in water. It is processed to comply with a specification given, which has been shown to define the minimum requirements for a satisfactory viewing medium.

Alkathene Trophy Goes to Ekco

The I.C.I. Alkathene design trophy, an award offered to moulders using Alkathene polythene for their retail articles has been awarded to Ekco Plastics Ltd., Southend-on-Sea, for their new Slimline toilet seat assembly. The competition was inaugurated by I.C.I. Plastics Division, to encourage original design and stimulate development in the use of plastics. 1958 was the first year of the award so that Ekco become the first winners of the trophy, which is handwrought in silver and wood.

Materials for Gas Chromatography

To provide uniform supplies over a period of years, the British Drug Houses Ltd., Poole, Dorset, have purified large quantities of stationary phase materials for gas chromatography, which are now held in stock as single batches.

The materials are: benzyl-diphenyl, diethyl-digol, diglycerol, dimethyl sulpholane, dinonyl phthalate, form-dimethylamide, *n*-hexadecane, 2:6:10:15:19:23-hexamethyltetracosane and tritolyl phosphate.

New Plastic Ranges

Three new developments of Undulite plastic sheeting have been announced by the plastics division of Dexion Ltd.

Undulite is a fibreglass reinforced translucent plastic sheet. Undulite 1 in. reeded sheet is being marketed in standard weights, and can be supplied clear or diffused in 11 colours. It is intended chiefly for decorative purposes in hospitals, hotels, offices and restaurants.

Dexion are also producing an additional width of Undulite in standard ranges to match 3 in. metal corrugation, particularly for the Cellactite new width of 34½ in. A new sheeting to match Turners asbestos combined sheeting is also being made.

Wellcome's Research Building

The Wellcome Foundation Ltd. have awarded Taylor Woodrow Construction Ltd. a £400,000 contract for the erection of a research building at Langley Court, Beckenham, Kent.

New Grade of Epoxide Resin

Bakelite Ltd., 12-18 Grosvenor Gardens, London S.W.1, are marketing a new grade of epoxide resin (DR. 19120) which, with hardener DQ. 19121 (phthalic anhydride), gives a hot curing system specially suitable for potting and casting in the electrical industry. The system is said to have a long pot life, low viscosity when molten, and the castings have very good electrical properties which are retained at elevated temperatures.

The low initial viscosity of the system at 120°C gives good penetration between components in potting and enables large proportions of inert filler to be incorporated into the mix. Long liquid life at the same temperature allows adequate time for de-gassing under vacuum and only slight exotherm is developed on curing.

DIARY DATES

MONDAY 16 FEBRUARY

S.C.I.—London: 14 Belgrave Square, S.W.1., 5.30 p.m. 'Role of surface active substances in the application of pesticides,' by Dr. G. Hartley.
S.C.I.—London: Windsor Castle Hotel, Victoria, S.W.1., annual dinner, Pesticides Group.
C.S.—Leicester: The University, 7.30 p.m. 'The triplet state in chemistry,' by Prof. G. Porter.
G.S. with R.I.C.—Oxford: Inorganic Chem. lecture Theatre, 8.15 p.m. 'Electrophilic substitution at nitrogen and oxygen,' by Prof. Sir Christopher Ingold.

TUESDAY 17 FEBRUARY

S.C.I.—London: The Royal Empire Soc., Northumberland Av., W.C.2., 6.30 p.m., film evening.
Fertiliser Soc.—London: Geological Soc. lecture hall, Burlington House, W.1., 2.30 p.m. 'Mechanism of granule formation,' by Prof. D. M. Newitt and Mr. A. L. Papadopoulas.

WEDNESDAY 18 FEBRUARY

R.I.C.—London: Kings' College, Strand, W.C.2., 6.30 p.m. 'Chemical aspects of fire prevention,' by Dr. F. E. T. Kingman.
Plastics Inst.—Newcastle on Tyne: Eldon Grill, Grey St., 7 p.m. 'Application of polyester resins' by Mr. E. Boott.
Plastics Inst.—Glasgow: More's Hotel, 7.30 p.m. 'European Free Trade,' by Mr. P. Russell.
C.S.—Dublin: Trinity Coll., 7.45 p.m. 'Epoxidation in the flavonoid series,' by Prof. T. S. Wheeler.
C.S. with R.I.C.—Norton on Tees: William Newton School, 7.30 p.m. 'Recent progress in the chemistry of dyes,' by Prof. W. Bradley.
Soc. Instr. Technology—Newcastle on Tyne: King's College, 7 p.m. 'Variable area flowmeters,' by Mr. F. C. Whalen.

THURSDAY 19 FEBRUARY

S.C.I.—London: 14 Belgrave Sq., S.W.1., 6 p.m. 'Paint and paint films as chemical and physical structures,' by Dr. S. H. Bell.
Royal Soc.—London: Burlington House, 4.30 p.m. 'Some chemical advances in the Ministry of Supply,' by Sir Owen Wansbrough-Jones.
C.S. with R.I.C. and S.C.I.—Gloucester: Technical College, 7.30 p.m. 'Science in the detection of crime,' by Dr. F. G. Tryhorn.
C.S. with R.I.C. and S.C.I.—Edinburgh: North British Hotel, 7 p.m. 'Recent advances in the structural analysis of polysaccharides,' by Dr. D. J. Manners.
C.S., with Alchemists' Club—Glasgow: The University, 4 p.m. 'Organic crystal chemistry,' by Mr. H. M. Powell.
C.S. with Univ. Student Chem. Soc.—Hull: The University, 6 p.m. 'Crystalline high polymers,' by Prof. C. E. H. Bawn.
C.S.—Manchester: The University, 6.30 p.m. 'Some recent advances in quantum chemistry,' by Prof. H. C. Longuet-Higgins.

FRIDAY 20 FEBRUARY

S.A.C.—London: School of Pharmacy, 29-39 Brunswick Square, W.C.1., 5 p.m. visit to laboratories, 6.45 annual general meeting of microchemistry group.
Plastics Inst.—Birmingham: James Watt Memorial Inst., Great Charles St., 6.30 p.m. 'Recent developments in the applications of epoxy resins,' by Mr. P. A. Dunn.
C.S. with R.I.C. and S.C.I.—Bristol: The University, 6.30 p.m. 'Some aspects of phosphorylation,' by Sir Alexander Todd.
S.C.I.—London: 14 Belgrave Sq., S.W.1., 7 p.m. Fine chemicals group conversazione.
C.S.—with Univ. Chem. Soc.—Cambridge: 8.30 p.m. 'The electron-pair bond,' by Dr. J. W. Linnett.
C.S.—Newcastle: King's College, 5.30 p.m. 'Recent developments in the chemical applications of nuclear resonance spectroscopy,' by Dr. R. E. Richards.

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NEW PATENTS

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Specifications filed in connection with the acceptances in the following list will be open to public inspection on the dates shown. Opposition to the grant of a patent on any of the applications listed may be lodged by filing patents form 12 at any time within the prescribed period.

AMENDED SPECIFICATIONS

On sale 18 March

Anti-corrosion oils. Japes, D. H., & ors. **586 679**
Solid polymers of ethylene. Imperial Chemical Industries Ltd. **762 592**
Granular material. Goodwin, Barsby & Co. Ltd. **788 067**

ACCEPTANCES

Open to public inspection 18 March

Simultaneous production of refined shark liver oil and vitamin A concentrates along with the recovery of other therapeutically active by-products. Mahdihassan, S., Mohuddin, M. Ali, S. M., and Haq, S. A. **810 643**
Epoxy polymerisable and polymerised compositions and a process for their preparation. Union Carbide Corp. **810 412**
Production of O.O-dialkylphosphoric or O.O-dialkylthionophosphoric acid esters of N-alkyllactams. Badische Anilin- & Soda-Fabrik A.G. **810 646**
Resolution of N-acyl-DL-tryptophans. Du Pont de Nemours & Co., E. I. **810 535**
Polymeric products for use as a lubricating oil additive. Esso Standard Soc. Anon. Francaise. **810 647**
Anti-corrosion compositions. Esso Standard Soc. Anon. Francaise. [Addition to 782 879.] **810 715**
Production of acrylic acid and its esters. Badische Anilin- & Soda-Fabrik A.G. **810 536**
Sweetening composition. Upjohn Co. **810 537**
Production of aryloxy acetic acid amides. Geigy A.G., J. R. **810 539**
Thionylcaffeyl chloride. Soc. Farmaceutici Italia. [Divided out of 810 375.] **810 376**

Open to public inspection 25 March

Manufacture of organic phosphorus compounds. Minister of Supply. **810 930**
Purifying titanium tetrahalides or zirconium tetrahalides. Laporte Titanium, Ltd. **810 822**
Manufacture of ion-exchange resins. Veb Farbenfabrik Wolfen. **811 012**
Supporting of filters and funnels. Pearce, T. W. **810 825**
Method and means for washing operations. Demaret, J. **810 864**
Coating compositions. Heijmer, G. B. **810 978**
Manufacture of a finely dispersed vat dyestuff of the pyrenequinone series. Farbwerke Hoechst A.G. **810 980**
Apparatus for stretching or shrinking continuously moving fully synthetic filaments or tapes. Farbenfabriken Bayer A.G. **810 922**
Producing metal hydrides containing boron. Metallgesellschaft A.G. **810 726**
Combined coking and thermal cracking process. Esso Research & Engineering Co. **810 808**
Coated thermoplastic polymeric films. Du Pont De Nemours & Co., E. I. **810 721 & 810 722**
Formation of drops of liquid. Badische Anilin- & Soda-Fabrik A.G. [Addition to 7:89 685.] **811 032**
Polymerisable compositions. Imperial Chemical Industries, Ltd. **810 940**
Solid foam products produced from polyester resins and polyisocyanates. Napier & Son, Ltd., D. **810 839**
Alloys and the metallising of ceramic or cermet materials therewith. Sylvania Electric Products, Inc. **810 774**
Production of polyvinyl polymers and in conveyer and similar belting produced therefrom. Greengate & Irwell Co. Ltd. **810 841**
Monoazo heterocyclic dyestuffs. Badische Anilin- & Soda-Fabrik A.G. **810 736**
Method for desulphurising molten pig iron. Institut de Recherches De La Siderurgie. **810 960**
Polyethylene structures. Du Pont de Nemours & Co., E. I. **810 723**
Copolymers of trifluoroethyl vinyl ether and vinyl esters. Air Reduction Co., Inc. **811 037**
Production of cycloaliphatic 1.2-diamines and the resulting products. Geigy, A.G., J. R. **810 844**
Apparatus for the detection of combustible gases in an atmosphere. Coal Industry (Patents). Ltd. **810 965**
Metal complexes of dyestuffs of the benzenemonoaze-hydroxy-naphthazole series, and their use. Geigy A.G., J. R. **810 745**
Pyrimidine compounds and processes for producing same. Farbenfabriken Bayer A.G. **810 846**
Preparation of therapeutic magnesium aluminate hydrate. Byk-Gulden Lomberg Chemische Fabrik G.m.b.H. **810 816**
Perfume compositions. Unilever, Ltd. **810 748**
Process for the hydrolysis of pyrrolidone carboxylic acid in alkaline liquids. Centrale Suiker Maatschappij N.V. **810 851**
Production of di-benanthronyls and derivatives thereof. Fairweather, H. G. C. (General Aniline & Film Corp.). **810 878**
4-Aryl-' (substituted)-piperidine - 4 - carboxylates. Sterling Drug, Inc. **810 853**
Coating of polyethylene terephthalate film. Du Pont De Nemours & Co., E. I. **810 854**
Catalyst and process for the dealkylation of aromatic hydrocarbons. Coal Tar Research Assoc. **810 751**
Steroids and the manufacture thereof. Upjohn Co. **810 858 & 810 859**
Liquid separators for use in plant for the manufacture of paper and cellulosic webs. Sulzer Freres S.A. **810 753**
Production of melamine. Bergwerksverband Zur Verwertung Von Schutzrechten Der Kohlentechnik G.m.b.H. **810 883**
Process for stabilising and reducing the viscosity of halogenated hydrocarbon resins. Ferro Chemical Corp. **810 885**
Manufacture of soap powders. Unilever, Ltd. **810 755**
Therapeutically valuable esters of 3:5:5-trimethylcyclohexanol and mandelic acid, and a process for the preparation thereof. Koninklijke Pharmaceutische Fabrieken Voorheen Brocades-Stheeman & Pharmacia N.V. **810 888**
Scrubbing of the interior surfaces of cooling zones. Du Pont De Nemours & Co., E. I. **810 889**
Stuck sleeve or socket joints in polyethylene pipes. Chemische Werke Hüls A.G. **810 891**
Tertiary amine oxides and their use in dyestuff preparations. Imperial Chemical Industries, Ltd. **811 046**
Manufacture of terephthalic acid and its salts and other derivatives. Henkel & Cie G.m.b.H. **810 893**
Method of indicating excessive quantities of water in liquids of low water solubilities. Ansul Chemical Co. **810 947**
Vapour phase polymerisation of ethylene-containing gas streams. Phillips Petroleum Co. [Divided out of 809 784.] **810 948**
Pressure filtration. Preparation Industrielle Des Combustibles. **811 024**
Separation of n-paraffins from hydrocarbon oils. Edeleanu G.m.b.H. **810 788**
Treatment of petroleum wax. Sun Chemical Corp. **810 904**
Coloured detergents or washing adjuvants. Henkel & Cie. G.m.b.H. **811 028**
Titanium-base alloys. Metallgesellschaft A.G. **810 949**
Method for the preparation of a fertiliser containing urea and ammonium sulphate, with a high nitrogen content. Bergwerksgesellschaft Hibernia A.G. **810 760**
Hydrogenation of acetylenic carbinols. Hoffman-La Roche & Co. A.G., F. **810 913**
Production of highly concentrated hydrogen peroxide solutions. Deutsche Gold- Und Silber-Scheideanstalt Vorm. Roessler. **811 050**
Utilisation of by-products from manufacture of 2, 5-dimethyl-piperazine. Dow Chemical Co. **810 916**
Manufacture of monovinylacetylene. Du Pont De Nemours & Co., E. I. **810 761**
Producing large sodium bicarbonate crystals. Dow Chemical Co. **811 053**
Salts of oestrone sulphate and the manufacture thereof. Schering A.G. **810 917**
Preventing the agglomeration of hexamethylene tetramine. Badische Anilin- & Soda-Fabrik A.G. **810 765**
Method of producing concentrated sulphuric acid and oleum from gases containing hydrogen sulphide. Metallgesellschaft A.G. **811 058**
Process for the continuous separation of gas mixtures by means of gas chromatography. Deutsche Erdol- A.G. **810 767**

Open to public inspection 2 April

Testing a sample of quartzide for use as source material in a hydrothermal quartz crystal growing process. General Electric Co., Ltd., and Brown, C. S. **811 213**
Method of growing quartz crystals. General Electric Co., Ltd., Brown, C. S., and Kell, R. C. **811 214**
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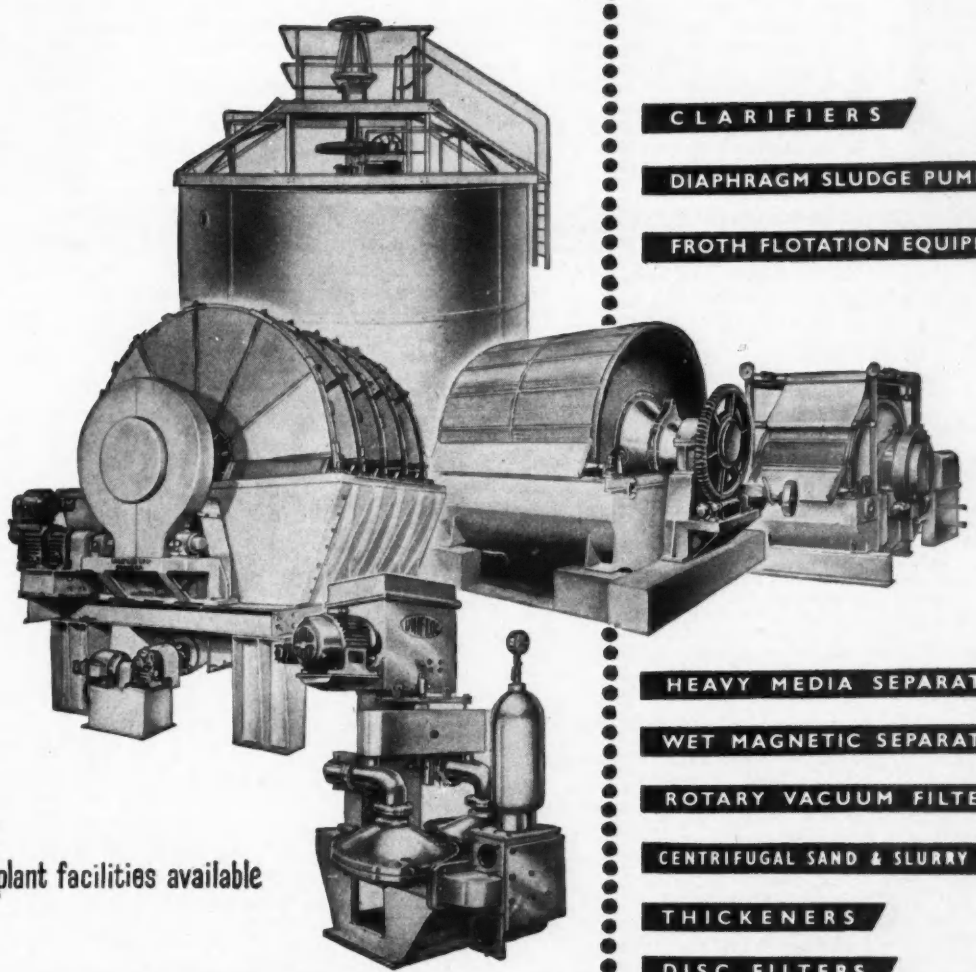

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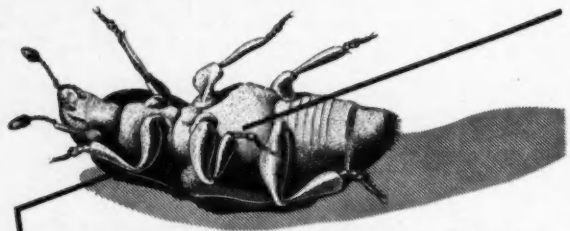

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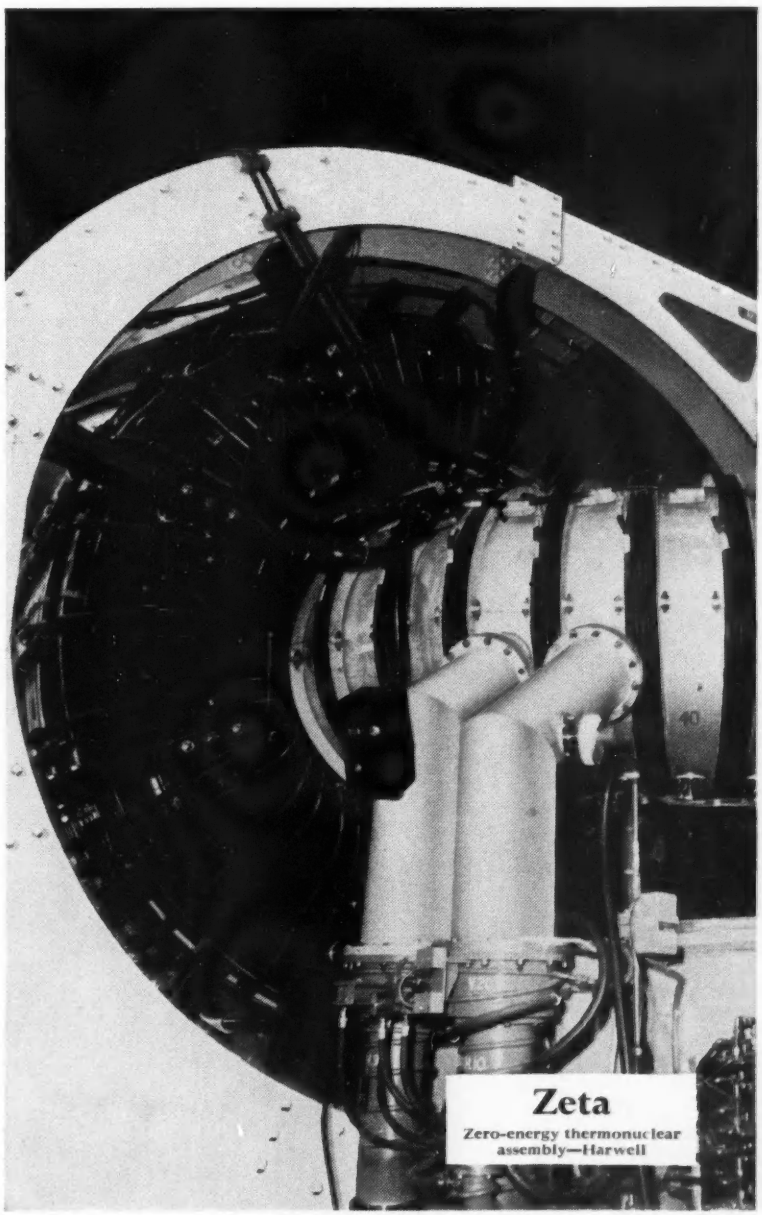

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